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Military Surgery in Peace Time—*Ivy*

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EDITORIAL

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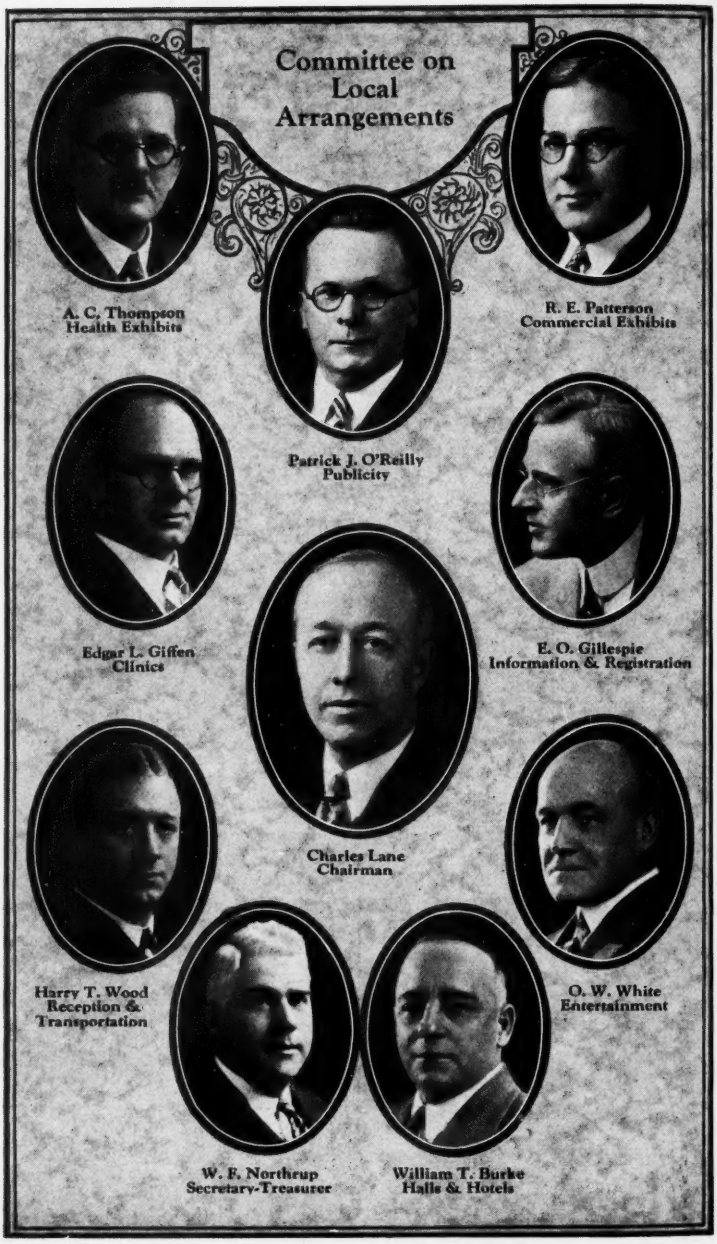

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Original Communications

A RADIOGRAPHIC STUDY OF ORTHODONTIC TOOTH MOVEMENT: A PRELIMINARY REPORT*

By ALBERT H. KETCHAM, D.D.S., Denver, Colorado

A RADIOGRAPHIC survey of 385 treated cases in my orthodontic practice has disclosed conditions in regard to apical root resorptions so startling, so potent in danger to the orthodontic patient, so prolific of recrimination to the orthodontist himself, that I make bold to present this preliminary report to the orthodontists of the world.

Grateful acknowledgment hereby is made of help from members of the dental profession in the preparation of this report. I shall use three cases, other than those from my own practice, to show that tooth root resorption is not confined to one locality. In order to secure even an approximate degree of accuracy in determining frequency of resorptions, I have been obliged to use cases from my own practice.

As this is a preliminary report of the investigation, it is impossible, at this time, to reach definite conclusions in regard to the causes of root resorptions; not only are there many phases to the subject, but there are also comparatively few statements in the literature dealing with this problem. All I can hope to accomplish at this time is to interest orthodontists in the subject, with the desire that all will check their cases thoroughly, and collect and correlate all available material. In this manner, men with trained minds, having the required scientific background, may assist in the investigation of this problem, and, if possible, we may arrive at a solution.

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

ANATOMIC VARIATIONS

In approaching the subject of anatomic variations, let us first consider the evidence that it is not unusual for teeth

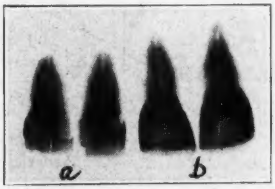

Fig. 1 (Cases A and B).—Extracted central incisors with short roots, not resorbed. Such teeth are not uncommon, and may be designated as anatomic variations.

to have short roots. In the extracted maxillary central incisors shown in Figure 1 (Cases A and B), the roots taper abruptly to rather blunt ends, without the amputated appearance characteristic of resorptions. They may be called anatomic variations. The radiodontist not infrequently discovers teeth with similar roots in mouths in which there has been no orthodontic intervention.

Figure 2, Case C, illustrates teeth with short roots. These are particularly interesting in that they are in the mouth of a tall, strong woman, aged 23, who has always been healthy. Had this been an orthodontic case, how natural it would have been to make a diagnosis of root resorption induced through orthodontic intervention.

Case D, illustrated in Figure 3, is of a patient, aged 16, who was referred for diagnosis before orthodontic treatment. The radiograms show pathologic conditions, but it is doubtful that the pressure produced by the impacted supernumerary tooth and cyst was the cause of the shortened roots. This hypothesis is supported by an examination in the maxillary region of the left side of the mouth in which the second bicuspid is apparently as short as the second

Fig. 2 (Case C).—Teeth having large, well formed crowns with short roots, in a tall, well formed, healthy, young woman. There was no orthodontic treatment.

Fig. 3 (Case D).—Left maxillary central incisor and mandibular second molars, which may be classed as anatomic variations; in a girl, aged 16. Right maxillary cuspid and first bicuspid, showing apical root resorption, perhaps due to the presence of a cyst, and maxillary second bicuspid roots, showing either resorption or arrested development.

bicuspid on the right side; and the left lateral incisor root is no longer than the right. This may be a borderline case, or one in which some of the teeth may be called anatomic variations and other teeth are resorbed.

Fig. 4 (Case E).—Left: Case in a girl, aged 8, showing length of the permanent right lateral incisor root. Center and right: Same case, at 10 years of age, showing resorption of the lateral incisor root.

RESORPTION THROUGH IMPACTION

Resorption of the roots of permanent teeth, which has apparently occurred on account of the proximity of the crown of an impacted permanent tooth to the affected root, is comparatively common.

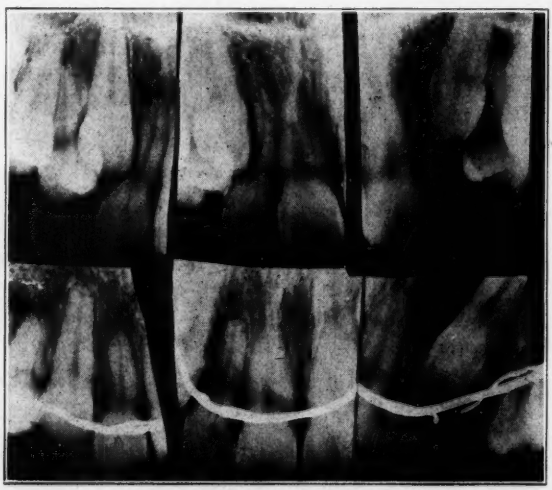

Fig. 5 (Case F).—Above: Resorption of the distal sides of the roots of the maxillary lateral incisors. The close proximity of the crowns of the impacted cuspids may be noted. Below: Two years later; left: Resorption at the distal side of the lateral incisor root, arrested through securing space and allowing the cuspid to erupt. The root apex of this tooth has resorbed.

In Figure 4, Case E, apical root resorption is shown, with the ultimate loss of the permanent right maxillary lateral incisor. The first radiogram, made when the patient was 8 years of age, shows the right cuspid directly over the root end of the lateral incisor. In an endeavor to stimulate development so that the impacted permanent cuspid would move toward its normal position, the maxillary arch was expanded rapidly in the region of the right deciduous molars and cuspid. The second and third radiograms show that this effort was only partially successful, and that resorption of the lateral incisor root continued.

Fig. 6 (Case G).—Case of extreme malocclusion, in a woman, aged 22. The extracted incisors show apical root resorption.

Figure 5, Case F, shows a series of radiograms loaned by Allen H. Suggett. The first series, made before treatment, show resorption on the distal sides of the maxillary lateral incisor roots, apparently due to the proximity of the crowns of the impacted cuspid teeth. The second series, made a year later, or after expansion of the arch to make room for the eruption of the left cuspid, show some resorption of the end of the left lateral incisor root.

RESORPTION DURING TREATMENT

Figure 6, Case G, shows radiograms of extracted maxillary incisors in which the right central and left lateral incisors were vital, and the left central and right lateral were pulpless. The roots, ap-

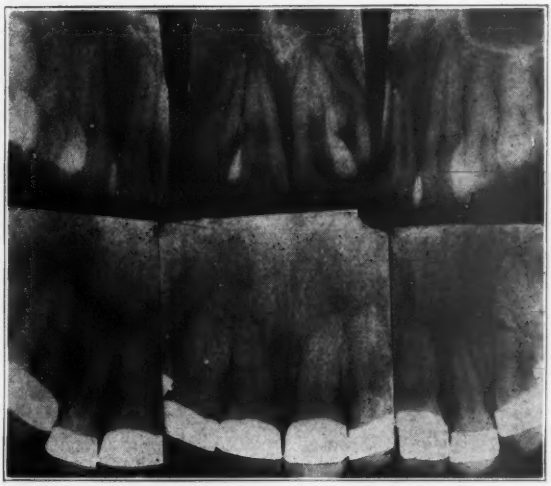

Fig. 7 (Case H).—Above: Case in a girl, aged 17. Below: Apical root resorption of incisors after two years of orthodontic treatment.

parently once fully formed, have become shortened, except the left lateral, with the apices as blunt as though they had been amputated. In the radiograms, these present an appearance similar to many of the tooth roots that have been observed in radiograms of orthodontic patients. These teeth had not received orthodontic treatment; neither had the teeth in Figures 1, 2 and 3.

Now let us study a little more intensively the interpretation of root resorption. Figure 7, Case H, shows the maxillary incisors in an open-bite case in a patient, aged 17, the first series being made in September, 1922. The second series were made after two years' treatment. These show the lateral and central incisor roots with typical amputated appearance. Radiograms of the mandibular teeth, made on the same dates as those of the maxillary teeth, show that there has been no resorption of these incisor roots, although the same type of appliance (the ribbon-bracket) was used on both.

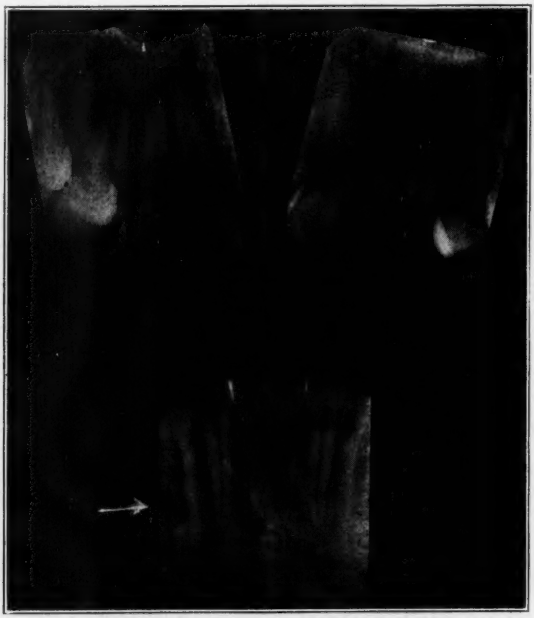

Fig. 8 (Case I).—Case in a girl, aged 12. The arrow (lower radiogram) points to the spot which later proved to be the crypt of a supernumerary tooth.

Figure 8, Case I, shows the first radiograms of a 12-year-old patient. These show the condition of the incisor roots in a distoclusion case in which the maxillary cuspids were protruding without space in the arch for their reception. Attention is called to the small spot in the film next the left mandibular cuspid, indicated by an arrow.

This patient was treated with bands on the maxillary incisors having hooks on the labial surfaces, in which a round arch wire of 0.030 diameter rested. The radiograms in Figure 9, Case I, were made seven and a half months after those in Figure 8. Attention is called to the change in the apical end of the left maxillary lateral incisor root, also to the increase in density of the above-mentioned spot over the root of the mandibular left canine.

The third series of radiograms of this patient (Fig. 10), Case I, were made one year after those in Figure 9. These show the progressive loss through resorption of the apical ends of the maxillary lateral incisor roots. The radiograms of the left mandibular cuspid region show the opaque spot to be a supernumerary tooth, which is forming in a lingual position between the cuspid and first bicuspid.

The extra-oral radiograms made in the first roentgen-ray examination did not include the left mandibular first bicuspid and cuspid region; neither did the intradental radiograms. This emphasizes the importance of covering each and every tooth and a portion of the jaw surrounding the teeth in the roentgen-ray examination.

Figure 11, Case J, shows the radiogram of the right maxillary incisor re-

Fig. 9 (Case I) —Case shown in Figure 8; seven and one-half months later. The apex of the root of the left maxillary lateral incisor shows signs of resorption. In the lower radiogram, a slight deposit of enamel is shown in the crypt of the supernumerary tooth.

Fig. 10 (Case I).—Case shown in Figure 9; one year later. The upper row shows resorption of the apical root ends of the maxillary lateral incisors. The lower row shows that the supernumerary tooth is assuming the form of a bicuspid.

Fig. 11 (Case J).—Case in a girl, aged 14. The well developed roots of the central and lateral incisors, also the impacted cuspid, may be noted.

gion in the case of a patient, aged 14, at the beginning of treatment. Unfortunately, the radiograms of the incisors, made before treatment was started, are not clear enough for good reproduction; however, Figure 11 shows that the root of the right maxillary central incisor was well formed. The right maxillary cuspid was impacted, with the lateral incisor almost touching the first bicuspid. Bracket-bands were placed on the maxillary lateral incisors and the right central incisor, while the left central incisor was only ligated to the ribbon arch.

Fig. 12 (Case J).—Case shown in Figure 11; two years later. The ribbon-bracket appliance was attached to the maxillary lateral incisors and right central incisor, while the left central incisor was attached to the ribbon arch by means of a ligature. The ribbon arch extended from lateral incisor bands to bands on the first molars. The incisors on the left were allowed greater freedom of movement during mastication than the incisors on the right. The apical root ends of the left maxillary central and lateral incisors are only slightly resorbed, while those of the right central and lateral incisors show marked resorption.

The varying degree of resorption of the right and left central incisor roots is shown by the radiograms in Figure 12, Case J, made two years after beginning treatment. A lingual appliance with auxiliary springs was used on the mandibular teeth. There has apparently been some resorption of the ends

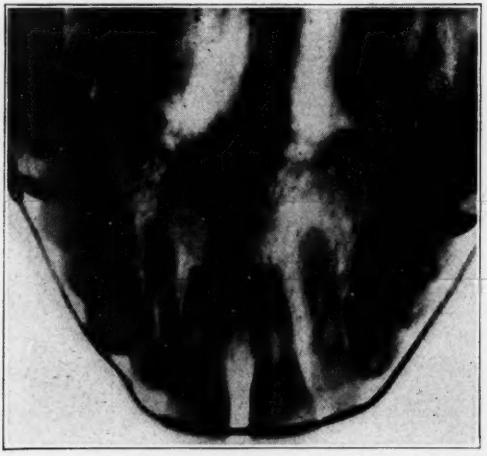

Fig. 13 (Case K).—Resorption of the incisor root apices, active before tooth movement was instituted (case in a youth, aged 20).

Fig. 14 (Case K).—Case shown in Figure 13; two years later. Resorption has progressed until the incisor roots are very short.

Fig. 15 (Case L).—Case in a girl aged 14, after one year and four months treatment. No radiograms were taken before treatment.

of the roots of these mandibular incisors.

Fig. 16 (Case M).—Resorption of the root ends of the maxillary incisors and probably of the ends of the distal roots of the mandibular first molars, in a boy, aged 15.

The radiograms of Case K, Figures 13 and 14, are furnished by an orthodontist on the Pacific Coast. These illustrate the importance of a correct interpretation before treatment is instituted. Figure 13 is a radiogram of the maxillary incisors of a youth at the age of 20. This radiogram was made before any pressure was applied to the teeth in orthodontic treatment, although it shows the plain arch in place. Unfortunately, the orthodontist did not notice that resorption of the maxillary central incisor root-ends was taking place before he started treatment.

The second radiogram, Figure 14, Case K, shows these teeth two years later. At the beginning of treatment, the

Fig. 17 (Case N).—Resorption of root ends of the right maxillary molar, in a girl, aged 17.

incisors were protruding, a plain round arch resting in open tubes being used to move these teeth backward. No attachment except ligatures was made to the lateral incisors. One might think that the incisors were foreshortened from the angle of the roentgen-ray tube, being higher than in the first radiogram; but measurements from the incisal ends of the central incisors to the lower nasal border show the distance to be the same in each radiogram. As the angle of these incisors has been changed to one more nearly vertical through the orthodontic treatment, the teeth are shortened in the second radiogram. The orthodontist writes as follows in regard to this case:

Fig. 18 (Case O).—Resorption, or arrested development of the apical root end of the left maxillary lateral incisor, apparently caused by close proximity of crown of impacted cuspid, in a girl, aged 17.

Fig. 19 (Case O).—Left lateral incisor which, twelve years after impaction of the cuspid was relieved and malocclusion corrected, is vital, firm and useful.

> You are welcome to use the X-rays of course but I would be *just as well pleased not* to have my name associated with the "disgraceful affair." I am not posing as a root amputator, and expect to do *less and less* in that line all the while now, so am not trying to advertise that *as a specialty*."

Figure 15, Case L, shows the radiograms of another case from the Pacific Coast. Unfortunately, we do not have radiograms of the case before treatment. The orthodontist who sent the radiograms wrote as follows:

You will find herewith a set of radiograms of great interest. The patient was a girl of 14 when orthodontic treatment was started. Ribbon arches were used on both the upper and lower teeth, being left there for one year and four months. Just how long a time was required for actual tooth movement cannot be ascertained, but it was a short period.

Figure 16, Case M, shows radiograms sent by an orthodontist on the Atlantic Coast, who gives the history of the case as follows:

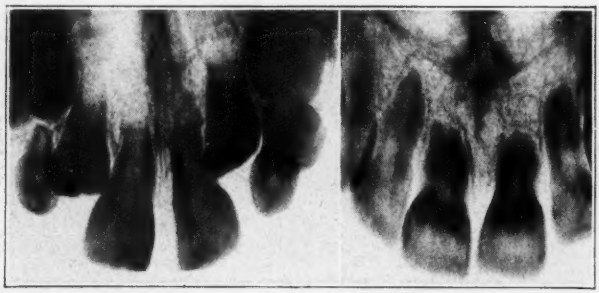

Fig. 20 (Case P).—Case in a girl, aged 8. Left: Maxillary incisors before treatment. Right: Incisors two years later. The development of the roots is apparently arrested.

This boy had been under treatment by another orthodontist for a period of about three years when referred to me at the age of 15. It was a severe case of open bite, which both

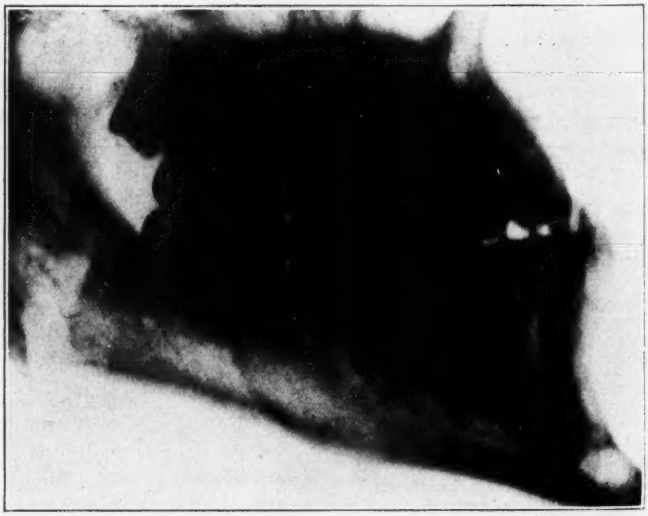

Fig. 21 (Case Q).—Extra-oral radiogram, left side; malocclusion Class III (Angle); in a boy, aged 17. The condition of the alveolar process around the mandibular molars is to be noted.

the former orthodontist and I struggled to keep from developing into a Class 3, as well as endeavoring to overcome the severe open bite. Needless to say there were bracket-bands on the twelve anterior teeth. I have no history of any resorption of the mandibular incisors. I desire also to call your attention to an apparent resorption of one root of each one of the mandibular first molars.

Diagnosis of resorption of apical root ends in the bicuspid and molar regions has sometimes been too obscure to permit of accurate interpretation, but that resorption is present in at least a small percentage of cases is shown by the radiogram on the right in Figure 17, Case N.

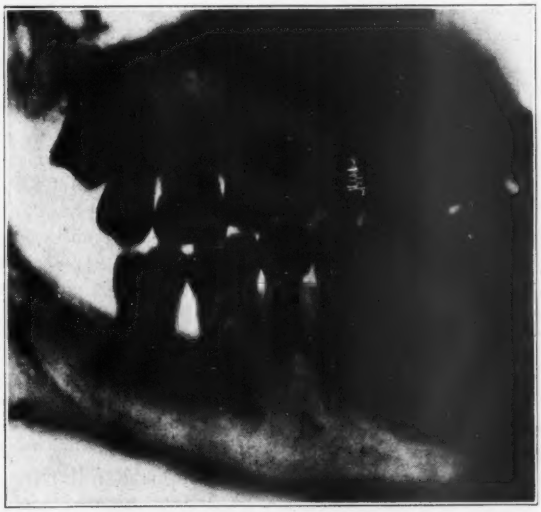

Fig. 22 (Case Q).—After one and one-half year's treatment. Loss of the alveolar process around the mandibular molars may be noted.

VITALITY OF TEETH

What of the future of teeth having shortened root ends? J. A. Gorman[1] shows a picture of a lateral incisor with resorption apparently caused by an impacted cuspid, the pulp retaining its vitality, and the tooth being firm enough for use years after the malposition and impaction of the cuspid had been corrected.

I had a similar experience twelve years ago, in a patient, aged 17. The two upper radiograms in Figure 18, Case O, show both maxillary cuspids impacted, while the second radiogram of the left lateral incisor shows the root end with an amputated appearance. Apparently, the left maxillary cuspid had either caused arrested development or resorption of the root end of the left lateral incisor. This lateral incisor responded positively to tests for vitality. The case was treated. The right cuspid erupted after space was secured for it in

1. Gorman, J. A.: Importance of a Thorough X-Ray Examination Before Treatment, Internat. J. Orthodontia, May, 1926.

the arch. The left cuspid was moved away from the end of the left lateral incisor root and into its normal place.

The radiograms made six years after treatment was completed are shown in Figure 19, Case O. This lateral incisor today, twelve years after treatment, responds positively to tests for pulp vitality. However, it takes more than these few cases to prove that the life and usefulness of these teeth with shortened roots have not been impaired.

RESORPTION—MAXILLARY VS. MANDIBULAR

This radiographic survey of 385 treated orthodontic cases shows definite resorptions of apical root ends of some of the anterior teeth of eighty-two patients, or 21 per cent.

Resorption in relation to the maxillary and mandibular teeth of these eighty-two patients was distributed as follows: twenty-seven patients had resorption of the some of the apical root ends of teeth in both maxillary and mandibular dental arches; fifty-two had resorption of the apical root ends of some of the maxillary teeth, with no resorption of the mandibular teeth. The remaining three showed resorption of some of the teeth in the mandibular arch, without resorption of the teeth in the maxillary arch.

There was resorption of some of the teeth in the maxillary dental arch in seventy-nine patients out of the total of eighty-two having resorption, or 96 per cent. There was resorption of some of the teeth in the mandibular arch in thirty-one patients out of eighty-two, or 37 per cent.

The foregoing indicates that the maxillary anterior teeth are more disposed to resorption than the mandibular.

Perhaps the comparison of patients with identical appliances on maxillary and mandibular teeth as given in Table 1 is more nearly correct. Of the total of thirty-two patients showing resorption in this classification, thirty had resorption of some of the apical root ends of the maxillary teeth, or 93 per cent; while seventeen had resorption of some of the apical root ends of the mandibular teeth, or 53 per cent. This also indicates that the maxillary teeth are more disposed to resorption than are the mandibular.

RESORPTION—IDENTICAL APPLIANCES

A further analysis of Table 1 reveals that identical types of appliances were used on both maxillary and mandibular teeth in the treatment of 161 patients, and that the number of patients showing resorption after treatment of the apical root ends of some of the anterior teeth in either maxillary or mandibular dental arches, or in both, was 32, or 20 per cent. The number and type of appliances used and the number of patients whose teeth showed resorption after treatment are shown to be as follows:

The pin and tube appliance was used to treat the maxillary and mandibular teeth of twelve patients, three of whom showed resorption of the apical root ends of some of the anterior teeth in both dental arches. One showed resorption of the apical root ends of some of the mandibular anterior teeth without resorption of the maxillary teeth; making a total of four patients showing resorption.

The ribbon and bracket appliance was used for the active period of treatment on both maxillary and mandibular teeth of forty-six patients, eleven of whom showed resorption of apical root ends of some of the anterior teeth in

both maxillary and mandibular dental arches. Another eleven showed resorption of some of the anterior maxillary tooth root ends, without resorption of the mandibular teeth. One showed resorption of some of the tooth root ends in the mandibular arch, without showing resorption of the maxillary teeth, making a total of twenty-three patients out of the forty-six who had resorption of the roots of some of the anterior teeth.

treat the maxillary and mandibular teeth of sixty-one patients, with resorption of the apical root ends of some of the teeth in both maxillary and mandibular dental arches of one patient. One patient showed resorption of the maxillary anterior tooth root ends without resorption of the mandibular teeth.

RESORPTION—DISSIMILAR APPLIANCES

Dissimilar types of appliances were used to treat the maxillary and mandib-

TABLE 1.—NUMBER OF PATIENTS TREATED WITH IDENTICAL TYPES OF APPLIANCES ON MAXILLARY AND MANDIBULAR TEETH, AND NUMBER OF PATIENTS SHOWING RESORPTION OF THE TEETH AFTER TREATMENT

Type of Appliance	Number of Patients	Number of Patients Showing Resorption			Total Number of Patients Showing Resorption
		Maxillary & Mandibular	Maxillary Only	Mandibular Only	
Pin & Tube	12	3	0	1	4
Ribbon-Bracket	46	11	11	1	23
Labial	42	0	3	0	3
Lingual	61	1	1	0	2
Total No. Patients	161	15	15	2	32

The labial appliance was used for the active period of treatment on the maxillary and mandibular teeth of forty-two patients, with no patient showing resorption of apical root ends in both the maxillary and the mandibular dental arches. Three patients showed resorption of the apical root ends of some of the teeth in the maxillary arch without showing resorption in the mandibular arch.

The lingual appliance was used to

ular teeth of 224 patients. Of these patients, fifty, or 22 per cent, showed resorption after treatment of the apical root ends of some of the anterior teeth in either maxillary or mandibular dental arches or in both. This resorption, with the type and number of appliances, is shown by Table 2 to be as follows:

The pin and tube appliance was used to treat the maxillary teeth of thirty-four patients, while the mandibular teeth were treated by other types of ap-

pliances, as indicated by the chart. Twelve patients are shown to have had resorption of the maxillary teeth and four of the mandibular teeth; i.e., eight showed resorption of some of the maxillary teeth alone, and four, resorption of both maxillary and mandibular teeth.

The ribbon bracket appliance was used to treat the maxillary teeth of sixty-five patients, while the mandibular teeth were treated with other types of appliances as indicated by the chart. Twenty-four patients are shown to have had resorption of the maxillary teeth, and six of the mandibular; thus, eighteen had resorption of the maxillary teeth alone, and six had resorption of both maxillary and mandibular teeth.

The labial appliance was used to treat the maxillary teeth of 112 patients, while the mandibular teeth were treated by other types of appliances, as indicated by the chart. Fourteen patients are shown by chart to have had resorption of the maxillary teeth, and four of the mandibular, but this is not correct for the one of the four showing resorption of the mandibular teeth and treated with the ribbon-bracket appliance upon these teeth did not have resorption of the maxillary teeth as shown, but resorption of the mandibular teeth only. In order to avoid additional complications in the chart, this one case is classified as indicated above. There were thirteen patients out of the 112 treated with the labial appliance

TABLE 2.—NUMBER OF PATIENTS TREATED WITH DISSIMILAR TYPES OF APPLIANCES ON MAXILLARY AND MANDIBULAR TEETH, AND NUMBER OF PATIENTS SHOWING RESORPTION OF TEETH AFTER TREATMENT

MAXILLARY				MANDIBULAR						
Number of Patients Treated	Appliances		Number of Patients with Resorption of Maxillary Teeth	Type of Appliances					Number of Patients with Resorption of Mandibular Teeth	Number of Patients Treated
	Type	Number		Pin & Tube	Ribbon-Bracket	Labial	Lingual	Without Appliance		
34	Pin & Tube	34	12	0	2	1	1	0	4	
				0	3	11	18	2		34
65	Ribbon-Bracket	65	24	0	0	3	3	0	6	
				0	0	10	55	0		65
112	Labial	112	14	0	1	0	3	0	4	
				2	7	0	90	13		112
13	Lingual	13	0	0	0	3	0	0	0	
				1	3	7	0	2		13
Totals										
224		224	50	0	3	4	7	0	14	
				3	13	28	163	17		224

on the maxillary teeth showing resorption of some of these teeth, and of the total of ninety patients who were treated with the lingual appliance on the mandibular teeth, three had resorption of both maxillary and mandibular teeth.

The lingual appliance was used to treat the maxillary teeth of thirteen patients, while the other types of appliances were used on the mandibular teeth, as shown by the chart. None of these patients showed resorption.

RESORPTION VS. APPLIANCES

Tables 1 and 2 show but few patients treated with the pin and tube appliance in comparison to the other types of appliances. Having made a radiographic examination of thirty-five treated orthodontic patients in succession, without finding evidence of tooth root resorption, except slight evidence in one case, and then having three cases showing marked evidence, I realize that error is likely to result from a comparison of but few cases.

It has been shown that the maxillary teeth are more disposed to resorption than the mandibular; hence, the results of an analysis of the cases shown in Table 2 cannot be justly indicated in terms of percentages. Therefore, it is impossible to make an accurate comparison of one type of appliance, and the resorption occurring during treatment, with any other type of appliance, and the resorption occurring during its use.

CONCLUSIONS

It may be asked: Are these cases of true resorption or anatomic anomalies? That they are not anatomic anomalies is shown by the fact that radiograms made at the beginning of treatment show that there was normal root length, while those made at the conclusion show that resorption has occurred.

It has also been shown in many cases under orthodontic treatment that definite root resorption takes place. Sometimes, this resorption occurs in spite of painstaking care to eliminate factors that are supposed to be detrimental to the tissues involved. When one considers this carefully, the conclusion will be reached that there is something besides appliances involved in this problem. It must be concluded that some people are more susceptible to disturbances during tooth movement than others, and that there may be an underlying cause or perhaps a hitherto unrecognized susceptibility to pathologic effects from mechanical stimuli.

Percy R. Howe[2] shows that when monkeys are fed a diet deficient in mineral salt and vitamins, a condition of depletion of the lime salt content of the bones and of the teeth of the animal is produced. The writer goes on to say:

> Hojer, in an excellent monograph on the subject, states that when *almost* enough of the antiscorbutic factor is furnished for the body requirements yet *not* enough, no pathology is to be found in the body *except in the teeth.* This represents a condition of latent antiscorbutic deficiency which often exists but that has been unrecognized.

Howe also states:

> We have teeth which *were* once fully formed, in which the *dentin* has become *nothing* but a softened mass.

When we consider the poorly balanced diet of the majority of our orthodontic patients, do we not have an insight into the underlying causes of resorption of tooth roots, namely, lack of lime salts, or calcium starvation in

2. Howe, P. R.: Dent. Summary, November, 1925.

greater or less degree, or faulty metabolism, with resultant susceptibility to tooth root resorption? It may be that extreme lack of development of the bones surrounding the roots of teeth which often determines the selection of a root moving appliance, is indicative of susceptibility on the part of the patient to tooth root resorption.

However, was it just chance that we had a high degree of susceptibility in fourteen of fifty-eight patients on whose teeth, both the maxillary and the mandibular, we placed pin and tube or ribbon and bracket appliances?

Was it just chance that these fourteen had root resorption of both maxillary and mandibular teeth?

Was it just chance that we had a high degree of susceptibility in only one patient of the 103 on whose teeth, both maxillary and mandibular, we placed plain labial or lingual appliances?

Was it just chance that only one had a high degree of susceptibility, so that only this one had resorption of both maxillary and mandibular tooth root ends?

After an analysis of these findings, I am of the opinion that the orthodontist must consider not only the predisposing susceptibility of the patient, but also the degree of immobility imparted to the teeth by the appliance. In other words, the orthodontist must consider to what degree the appliance, through immobilization, interferes with the normal function of the teeth and for how long a period of time this interference continues.

In concluding this preliminary report, I urge all orthodontists to secure accurate radiographic surveys of all cases before treatment, and then to recheck them often, compiling results so that many accurate data may be secured.

1232 Republic Building.

DISCUSSION

S. P. Cameron, Philadelphia, Pa.: We must all agree with Dr. Ketcham on the imperative need of frequent and complete radiographic examinations before, during and after orthodontic treatment. His paper, however, has been of special interest to me because of his reported findings in cases treated with the "pin and tube" and ribbon arch mechanisms. In the first case shown, he attributes arrested development in the roots of the central incisors to the ribbon arch mechanism and states that this probably held the teeth immovable during treatment and thus arrested the normal physiologic process. With this conclusion, I take issue. Dr. Ketcham stated that there were bracket bands on the central incisors only and that the anchor bands were on the first permanent molars. Such an adjustment resulted in a long area of unsupported, flexible, ribbon arch wire from molar tube to central bracket, which unquestionably moved far too freely under the impact of food during mastication; and hence the reaction shown on the central roots was more likely due to excessive "jiggling" of these teeth rather than immovability. This is faulty technic and cannot be charged to defects in the appliance. The idea that the ribbon arch mechanism, because of the perfection of its force control over the tooth to be moved, produces a stability of the tooth in the process that is dangerous because it is nonphysiologic is a most untenable deduction. Let us not forget the histologic structure of the peridental membrane and the delicacy of the ribbon arch itself, a combination which is absolutely prohibitive to stabilizing the tooth against the great forces of occlusion. It is not immovability that we need to worry about when using this appliance, but faulty and excessive tooth movements in the wrong direction, due again, I emphasize, to improper technic. We know that, in surgery, there are two types of operations, major and minor. The casualties in the latter group are almost a negative factor, while, in the former, complications are to be expected. Perfection in surgical technic has reduced these complications to a minimum. Any break in the chain of aseptic procedure is fatal to the best wel-

fare of the case, and the more complicated the operation, the more dangerous the mistake. In orthodontia, we have a similar classification of operations. We may term the treatment of cases with appliances that do not produce root movements as minor operations and the use of the root moving mechanisms, as major procedures; consequently, there is bound to be greater danger in the latter class of tooth movements than in the former. But these movements are absolutely necessary to the proper treatment of the vast majority of our cases, and they can be far more safely performed than can the major operations of surgery. The keystone to success lies in the mastering of a perfect technic in the use of these root moving mechanisms. The need of perfection of force control for the movement of teeth bodily in all directions is a nondebatable fact. The ribbon arch mechanism supplies this need completely. The danger of complications arriving from its use is in indirect ratio to the perfected technic of the operator, acquired only by careful and painstaking analysis of its hidden mechanics.

Dr. Ketcham (closing): The question of length of life of the teeth which we have found with resorbed roots has been raised. Dr. Ottolengui, in 1913, reported, before the American Society of Orthodontists, a case in which the maxillary incisor roots were badly resorbed.[3] Dr. Ottolengui reports that, after seventeen years, these teeth are alive and functioning normally, and that recent radiograms indicate that there has not been further resorption. Dr. Devries has asked whether the patients included in this radiographic survey were of the age in which the incisor tooth root ends should be completely formed. I would answer yes, the majority were, while of the balance, those classed as having resorption showed an arrested growth, as though the ends of the roots had been amputated. I have found arrested development taking place during the treatment as early as at 10 years of age, but only in one patient; and have found resorption taking place during treatment in a patient, aged 28. Dr. Strang and Dr. Cameron attribute the cause of resorption to "jiggling" imparted to the teeth, as in the case illustrated in Figure 20, Case P. This is the case I used in discussing the paper by J. A. Gorman,[1] under Figure 11, as follows: "Figure 11*A* shows the case of a girl 8 years of age, with the development of the roots of the central incisors having progressed until they are about the same length as the crowns. *B* shows it two years later when development of the central incisor roots has apparently stopped. In treating this case an arch (ribbon) rigidly locked to bands upon central incisors was used with anchorage bands upon first permanent molars. A little more pressure was exerted against the central incisors than usual, for the reason that the first permanent molars had tipped forward impacting the second premolars." Dr. Strang apparently ascribes the root disturbance to the long span of the ribbon arch which extended from the central incisors back to the first permanent molars without any intervening support, thus permitting "jiggling." I believe this to be a case of arrested development rather than of resorption, and I might mention that the health picture of the child, in regard to diet, was most unfavorable. She had an aversion to milk, green vegetables and fruits. She majored on the good staple American diet of meat, potatoes, white bread and dessert, being especially fond of sweets. I can recall but one other case in which "jiggling" could have been a possible factor in resorption. This is shown in Figure 21, Case Q, that of a youth, aged 17, with a most unfavorable health picture. The malocclusion was in Class III (Angle). After the removal of the mandibular third molars, an arch locked to bands on the six anterior teeth and having anchorage bands on the first permanent molars was applied to the mandibular teeth. Similar appliances were placed on the maxillary teeth. Intermaxillary ligatures were worn on each side from the buccal tube on the maxillary molar band to a hook on the arch at a point between the mandibular cuspid and first bicuspid. The radiogram in Figure 22, Case Q, shows the teeth a year and a half after treatment was instituted. Resorption of the alveolar process back of the mandibular first permanent molar is shown. The patient complained of soreness of this left lower molar when using light intermaxillary rubber ligature pressure. The roots of the incisors were not resorbed. This case is not classified among the eighty-two of resorption, though there may be some resorption of the mesial roots of the mandibular first permanent molars. I

3. Compare Figure 4 in Ottolengui, R.: Physiological and Pathological Resorption of Tooth Roots, Items of Int., 36: 332 (May) 1914.

would again suggest, for protection to patient and to operator, that all orthodontists make a complete radiographic survey of each patient before treatment, and then repeat the survey at frequent intervals. Then, it is only through having reports of radiographic surveys of a vast number of treated cases that we can arrive at any thing like accuracy in our conclusions. The comparison of the radiographic findings from those practices in which the ribbon-bracket and the pin and tube appliances have been used almost exclusively would be of especial value when compared to those practices in which the plain labial and lingual appliances had been used almost exclusively. Several orthodontists have written that they do not find so high a percentage of patients with root resorptions as I have found. This may be due to the fact that they have radiographed but a comparatively few of their treated cases. I have made radiographic surveys of thirty-five treated orthodontic patients in succession, without finding one case which I could class as showing resorption, while the next three or four showed the condition. Last week, at the First International Orthodontic Congress, in New York City, Percy R. Howe showed skulls of monkeys that had been on a diet deficient in vitamins, and also showed the skulls of those that had been fed upon a well balanced diet. Those on deficient diet showed not only lack of normal calcification of the bone of the skull and jaws, but also malocclusion of the teeth similar to that which the orthodontist is called on to treat in the mouths of children. Dr. Howe states that the roots of the teeth of the monkeys that have been upon a deficient diet are short. His observations, coupled with those of John A. Marshall and a number of other investigators have led me to believe that the majority of cases of malocclusion are due primarily to lack of normal calcification of the bones of the face and jaws. Upon this weak foundation are based any one, or several, of the etiologic factors of malocclusion, including disturbances of the ductless glands and external pressure habits. It may be that placing orthodontic appliances on the teeth of a child who is lacking in the proper calcification of the bones of the jaws and teeth may induce apical root resorption, just in proportion to the degree of the patient's susceptibility, and to the degree that the regulating appliances limit the normal exercise of the teeth. My findings in regard to root resorption, which took place in cases in which the pin and tube and ribbon-bracket appliances were used, in comparison with those cases in which the plain labial or lingual appliances were used, may not be accurate; or, in other words they may carry a wrong impression, for the reason that the first two mentioned appliances may have been used in cases presenting the most extreme malocclusion; or, in other words, on the patients whose bones and roots of teeth calcification was most deficient. It is in treatment of the more extreme forms of malocclusion that the pin and tube and ribbon-bracket appliances have been generally employed in my practice. It is among these cases that I find the highest percentage of apical root resorptions. Is the answer to be found in faulty tooth root calcification, granting that such a condition does exist, in type of appliance used, in faulty technic (though I believe that the appliances were skillfully applied and then adjusted carefully) or in a combination of all of these? I have had blood tests made for calcium content in several patients, and find that some who have had resorption of tooth roots now have a normal amount of calcium in the blood. Then a few who have some teeth apparently with roots undergoing active resorption show a normal amount of calcium, while the majority with active resorption show low calcium content of the blood. This is worthy of further investigation. It has been suggested that the mineral and vitamin content of foods produced in different localities may vary to a greater or less degree, so that foods from some localities may be deficient in those elements that produce well-calcified bones and teeth. This also would seem to be worthy of investigation.

INSTRUMENTS AND INSTRUMENTATION*

By R. D. THORNTON, D.D.S., Richmond, Virginia

CAREFUL consideration of the subject of instruments and instrumentation has led me to conclude that I am justified in departing from a detailed discussion of such points as working surfaces, blades, shanks, angles and hand grasps, and launching out on certain broad general principles that changing conditions have made necessary in the practice of operative dentistry. Two points of especial interest will, therefore, be introduced for discussion. The first is based upon the psychology of individual differences as it applies to operator and patient. The second refers to the changing conditions that have been effected by such advances as have been evolved from the newer knowledge of oral hygiene, improved metallic alloys, better prosthetic restorations and many other points of like interest.

The following quotation[1] from one of our textbooks in operative dentistry will serve to introduce the first point for discussion.

Frederick W. Taylor in his scientific shop management showed conclusively that there should be no such thing as unskilled labor. He started on the basis that there is a best way to do everything. He searched until this best way was discovered, and then he saw to it that each workman under his care was instructed and even compelled to use this way. Thus the workmen, instead of using various methods according to their individual whims, all became skilled workmen, to the great benefit of their employers and themselves. By his plan as simple a proceeding as loading pig-iron on a car was reduced from a haphazard process to a science. The man that could load only 12.5 tons of pig-iron a day when left to his own devices, under scientific management readily loaded 47 tons in the same time. Mr. Taylor found that 21 pounds was the proper weight for each shovelful for the average man if he would do his best work and not become tired during the day; he also showed the men the most efficient method of shoveling. Then, by having shovels of various sizes to suit the kind of material shoveled, he made a man carry in his shovel 21 pounds, whether he was shoveling iron ore, coal, or sawdust.

The great value of such a plan is obvious. Dentists are suffering from the lack of just such training. Each teacher in the dental schools is apt to advocate the methods used by his former teachers, which methods are varied according to the instructor's personal skill or mechanical bias. There is no standard best method which all students are taught. Some men employ methods that will obviously give better results in one-half the time. These methods should not be brushed aside as requiring skill unattainable by others. They should be studied and collected into a system that would stand as a model for all teachers to use until scientific research has demonstrated a further advance. In fact, the dentists of the future should be taught dentistry in reference to a recognized standard, both as regards rapidity and efficiency.

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

1. Head, Joseph: Modern Dentistry, Philadelphia, W. B. Saunders Co., 1920, pp. 142-143.

Reference to the activities of the American Institute of Dental Teachers, one of the organizations which amalgamated with others to form the present American Association of Dental Schools, reveals the fact that the principle enunciated in the previous quotation received the support of the institute, for it had a committee working on the problem of standardizing a minimum list of instruments for use in all dental schools. The failure of the institute to accomplish this objective seems to have been due to the fact that a wrong principle was being pursued rather than to any lack of ability or of application to the task on the part of the committee.

An American humorist wrote a story about an old uncle who had spent most of his life as a shoemaker. Believing that music offered a much more attractive vocation than shoemaking, he forsook his bench and lasts and took up the violin. As a result of the change, the world lost a good cobbler and got a very poor fiddler. He was a misplaced man. While this story was written for humor, it contains a great truth. It so frequently happens that when people pursue vocations for which they are not suited that much unhappiness and economic waste results.

Stephen Leacock, the Canadian humorist, is credited with the remark that when one of his business friends tells him that he resorts to translating several pages of Greek for rest and relaxation after an arduous day at the office, he knows instinctively that the fellow is deliberately lying. It is quite improbable that many business men find rest while translating Greek, because the characteristics necessary for a successful business career are essentially very different from those found in the classical scholar.

What constitutes a hobby for one individual may, of course, be very boresome to others. Psychologists have carefully studied many of our individual differences. Thorndyke[2] says

> The ability possessed by any individual in any mental trait is the result of (*a*) his original nature; (*b*) the extent to which his original tendencies have matured by mere inner growth, and (*c*) the circumstances of his life and training. His original nature is determined partly by sex, partly by his remote ancestry or race, partly by his near ancestry or family, and partly by the unknown causes of variation whereby children of the same parents receive differing inheritances.

According to this statement, it would seem that each individual begins life with certain inherited tendencies which may be modified, to some extent, by the "circumstances of his life and training" but which are fundamentally different from the tendencies inherited by his neighbors or even by other members of his immediate family. Pursuing this line of thought further, one is forced to conclude that it is quite illogical to expect a group of people to follow definite instructions regarding the performance of any operation and attain the same results. This remains true regardless of whether the instruction is given to undergraduate students in college or to practitioners assembled to watch a clinical demonstration. One of the reasons why such terms as "a modified Callahan" or "a modified Coolidge technic for filling root canals" creep into our dental literature is that the author of the modified technic finds himself in agreement with the original on general principles but is unable to accomplish his best results by the same

2. Thorndyke: Educational Psychology—Briefer Course, p. 340.

methods that were adopted by the originator of the technic.

Perhaps a word of caution should be inserted here against too great a departure from standardization. I firmly believe in standardization as far as it may be carried out without restricting the development of original ideas. Standardization should be applied to general principles. The degree of freedom that may be left to the individual depends largely on his intellectual capacity for improvement. Head's reference to Taylor's experience with men shoveling pig-iron is not very complimentary to the dental profession. There should be quite a marked difference, intellectually, between the class of men who earn a livelihood with a shovel in the scrap-iron yards and college graduates. Dental literature should be to dentists what Taylor was to his gangs of shovelmen, with one great difference. Taylor dictated what his men should do. Dental literature presents the ideas and methods of men interested in the progress of their profession, but the individual dentist is expected to read critically and select and assimilate whatever may assist him in developing his original talents. It is folly to believe that, because some operator casts a beautiful inlay by a certain method, the wax, investment material, casting machine and other agencies used by him are the best on the market and should be used by everyone.

Black's "Tabulated Instrumentation for Preparation of Cavities by Classes"[3] would seem to indicate that he believed in a best method for performing an operation which should be followed by everyone. After the tabulation, he states:[4]

> It should be borne in mind that these lists are only suggestive and many deviations will be necessary to meet conditions in particular cases. Generally, however, similar instruments of different sizes will be suitable. If one is ambitious to do the best operating in the least time, he should learn to systematize the preparation of each cavity so that each step will be performed in its proper order and the cutting to be done by each instrument will be completed while that instrument is in hand. He should learn to decide beforehand just what part of the preparation of a given cavity will be performed by each instrument to be used. If one will form the habit of selecting the instruments to be used in the preparation of each cavity and placing them on the operating tray in the order that he expects to use them, it will be of material aid in systematizing these operations. The illustrations of groups of instruments presented in connection with the preparation of cavities of each class, form a good basis for this study. If the operator will place these instruments on his tray in their proper order for each cavity to be prepared, he will soon learn what deviations from the list are necessary for particular cases.

He evidently recognized the necessity for some departure from a standardized technic, but attributes the cause to such factors as variations in the size, shape, location and accessibility of the cavity rather than to individual differences in operators. His plea for the systematic performance of each operation is highly commendable. Every operator should aim at systematizing his work, but the idea of standardizing technics and expecting everyone to follow them is wrong in principle.

Johnson,[5] on the other hand, distinctly states:

3. Black, G. V.: Operative Dentistry, Vol. 2, pp. 118-119.

4. Footnote 3, p. 120.

5. Johnson, C. N.: Principles and Practice of Filling Teeth, Ed. 4, Philadelphia, P. Blakiston's Son & Co., 1918, Introductory, p. xii.

The system of technic here suggested is not presented as being applicable to all operators or all patients. It is not even claimed that it is the best system, but merely that it is an attempt to formulate a definite and consecutive method of procedure in the performance of many of our operations, which in the past seem, for the most part, to have been performed without method and without system.

Conzett and Volland,[6] discussing the desirability of doing as much as possible with one instrument before dropping it to use another, say

The reason that so many operators are slow and sloven in their work is that they are slaves to their instruments and can only accomplish a very little with any instrument, and when that little is done, must, perforce, find another slightly different in design, in order to finish the operation. The real artist will accomplish more with a piece of chalk and a shingle than will a bungler with the finest outfit possible; therefore, every student should be the master of a few instruments and add to that list those that experience demonstrates are necessary and then master those.

They evidently believe that it is best for the operator to develop his skill with the instruments which he finds he can use best, regardless of what may be best suited to someone else.

These quotations from four of our formal textbooks on operative dentistry have been presented to show that marked differences of opinion on this subject confront the reader. I believe that each operator must work out for himself the instruments and methods of instrumentation by which he can produce the best results. He may gain much assistance from knowing the technic of others, but he must select from their methods those points that he can use for his own advancement. A best instrument by which all operators can obtain their best results in a given operation does not exist. Furthermore, different operators will frequently adopt different methods of instrumentation if required to use a given instrument for the performance of a certain operation. Of course, some fundamental principles must be observed. An attempt to develop a technic for cutting tooth tissue with an instrument designed for condensing plastic filling materials is doomed because the physical principles upon which the operation is based are being violated. But, one operator may find that he can bevel his enamel margins best by the use of chisel-edged instruments, while another obtains his best results by using fine, revolving stones, disks or burs in the engine.

The idiosyncrasies of the patient should be studied very carefully by the operator. Because one person dreads the use of the engine and bur, it does not necessarily follow that hand cutting instruments are best for all. Some people fear the use of the chisel more than stones or burs, especially when heavy hand pressure or the mallet is used. The operator who studies the feelings of his patient and adopts methods of instrumentation that cause the least discomfort has accomplished much toward removing from the public mind that horror of the dental chair that so often serves as an excuse for postponing the visits necessary for the proper care of the oral cavity. Most people like to feel that their dentist has some interest in them personally. If he can recall, either from mental or written notes, the preferences of the patient as observed on previous occasions, he has done much to establish

6. Ward, M. L.: American Text-Book of Operative Dentistry, Philadelphia, Lea & Febiger, 1920, p. 181.

confidence and thus enhance his reputation.

The second point in this paper regarding changing conditions in the practice of operative dentistry may be introduced by some quotations from Black's "Operative Dentistry," Vol. 2. His "Tabulated Instrumentation for Preparation of Cavities by Classes"[3] seems to have been based upon a consideration of cavities that were much larger than those that are encountered in practice today. The use of spoons 20-9-12 and gingival margin trimmers of the same dimensions for Class II cavities indicates that caries had wrought havoc with a large portion of the tooth. In discussing the preparation of a large pit cavity in the central fossa of an upper first molar, he says:[7] "If there is a considerable mass of decay obscuring the cavity, it may be first removed roughly by a few vigorous strokes with spoons 20-9-12 or 15-8-12." Again, when referring to the finishing of the enamel walls for Class II cavities, he states:[8]

> The cavo-surface angle of all parts of the cavity outline must now be beveled. All, except the gingival and the rounding of the bucco- and linguo-gingival angles, may be done with the chisels. Special instruments are required for beveling the gingival cavo-surface angle, the gingival margin trimmers 20(80)-9-12, rights and lefts, for mesial cavities, and 20(95)-9-12, rights and lefts, for distal cavities. These instruments are made especially for this purpose.

The following comment[9] is made regarding "deep occlusal cavities in molars."

> For filling with gold in a cavity of such depth, one should be careful to have the approach for plugging instruments such that the filling can be easily packed against every part of every wall of the cavity by direct mallet force. In upper first molars this is generally easily done when the walls are parallel with the long axis of the tooth. But in upper second and third molars and in any of the lower molars, the mesial wall or the mesial and part of the buccal wall or both should be sloped more toward the marginal ridge, cut to its crest, or even cut slightly over the marginal ridge, to give convenience and certainty in packing gold against them.

Having read these statements, one can better understand his notes regarding the use of handpieces when he says that, for Class I cavities[3] "It will occasionally be necessary to use the contra-angle hand-piece in occlusal cavities in lower molars, and occasionally in buccal and lingual pits in molars," and for Class II cavities: "Generally use the contra-angle hand-piece for distal cavities in lower molars and occasionally for distal cavities in upper molars." Today, the dentist whose clientele has been educated to visit him frequently should have only small cavities to fill when he is called on to treat caries. For prosthetic restorations, his cavity preparations are quite different from those of a few years ago because the newer alloys of gold give sufficient strength in abutment pieces without cutting so deeply into the tissues as seemed necessary before their introduction.

There is a principle in cavity preparation that the cavity must be large enough to receive the instruments necessary for the proper condensation of the filling material. This should not be misconstrued. When filling materials such as gold foil or amalgam are placed in a large cavity, condensing instruments with small working surfaces have a tendency to cut through the soft material because it can spread so easily.

7. Footnote 3, p. 126.
8. Footnote 3, pp. 153-154.
9. Footnote 3, p. 133.

If the same amount of filling material is placed in a small cavity and the same condensing instrument used, condensation may be produced much more readily. The walls of the cavity will prevent the spreading of the material to such a great extent and the desired result will be more quickly obtained. In filling small-sized cavities, the cross-section area of the cavity should, therefore, be an important determining factor in the selection of instruments. There is not the same need in a present-day operating outfit for instruments with large working surfaces and cutting edges that existed a decade or more ago. Operating equipment today should be designed for small cavities. There is no justification for destroying good tooth tissue to admit a plugger into the cavity. The educational work that is being carried on among the laity regarding oral hygiene is rapidly revolutionizing the operative procedures necessary. Large instruments are applicable only to the exceptional cases. Indeed, the smaller ones can be used very serviceably in the large cavities that present.

The gold alloys now available for inlay work have eliminated the necessity for cutting deeply into the dentin to get sufficient bulk of material to withstand the stress. The old-time undercut for retention purposes was another reason for deep-seated cavity preparations because the undercut had to be placed deeply enough in the tooth tissue to leave dentin in position to support the enamel walls. With pulp conservation playing such an important rôle in operative dentistry today, it seems advisable, in many cases, to include a large amount of the external surface of the tooth in order to gain resistance and retention form and thus avoid bringing foreign materials into close proximity to the pulp. Such preparations require the destruction of sound tooth tissue on the external surfaces. Carborundum disks and mounted and unmounted stones must, therefore, replace the chisel, spoon and hoe quite extensively.

The use of fine mounted stones and straight-cut finishing burs in the engine will usually produce smoother cavity walls than can be made with hand instruments. The rapidly revolving stone or bur acts on the same principle as the revolving plane used for dressing lumber, while the chance of producing a smooth surface with the hand instrument is dependent entirely on the skill developed by the operator. A few slight scores or scratches in the cavity walls are not a very serious matter if a plastic filling material is to be inserted. For inlay work, smooth walls are essential if an accurate wax pattern is to be obtained. In the past, the mounted stones have failed to give sufficient service to justify their cost. There seems to be some hope that this difficulty may be surmounted in the near future. The manufacturers of dental instruments and supplies can usually be relied on to play their part in the advancement of dentistry if there is sufficient demand for any product to compensate them for the expenditure necessary to bring about the desired improvement in the article.

CONCLUSION

An effort has been made in this paper, first, to present the thought that different individuals accomplish their best results in a given operation by widely different methods. Some people who are well adapted to follow certain vocations make miserable failures in

others. Given, then, a situation such as is found in the practice of dentistry, in which thousands of individuals pursue the same vocation, there must be a wide variation in the qualifications for success that they present; consequently, they cannot all be machined into interchangeable parts of one great unit. Applied to the subject of this paper, each dentist must improve his operative ability, which is governed largely by his original talents, by adopting from his college course, the dental literature, dental conventions, etc., in the words of Thorndyke, "the circumstances of his life and training," such factors as he finds by experience will make him a better operator.

Secondly, the knowledge possessed by the dental profession today is rapidly changing the conditions that have to be dealt with in practice. Evolution in instruments and instrumentation must therefore progress to conform to the new conditions. The individual dentist should play his part in this evolutionary process.

DISCUSSION

J. Ben Robinson, Baltimore, Md.: Operative dentistry, in its particular application, is accepted to mean the treatment of carious conditions of the teeth. The treatment of carious lesions not only requires the removal of all diseased tissue but also includes a permanent restoration of all destroyed tooth structure to its normal form and function, along lines that offer the least possibility of recurrence of decay. It matters not whether the extent of destruction is little or much, the requirements of the case remain the same as far as principle is concerned. Some one has said that wisdom consists in knowing what to do, judgment in knowing how to do it, and virtue in doing it. These are the trinity of successful enterprise. It will be noted that operative dentistry when analyzed and its requirements segregated presupposes the knowledge of what to do and how to do, and then the doing. Success or failure will result in proportion to our ability to conform to this formula in thought and action. The plans and specifications of cavity preparation are assumed to be standard along lines of adequate treatment, to call into play the use of instruments and their application to cavity preparation. In a discussion of instruments and instrumentation, we should realize that these agents are but a means to an end. They are designed to bring out in form the plan of permanent restoration. We might even admit that the character of instrument used would be of little consequence as long as our efforts are justified in the results obtained were it not for the fact that efficiency and economy impose a consideration of the means consonant with personal satisfaction and reasonable dispatch. Mr. Taylor, as quoted by Dr. Thornton, says, "There is a best way," which means a right way. This statement implies a rational procedure to be employed to attain a given objective, which, in operative dentistry, is accepted as referring to the means. There may be a question raised as to the relative merits of hand instruments and engine instruments in the preparation of a cavity, but I am convinced that either is a right way, while the best way is a matter of personal choice. In this respect, may I venture the assertion that the talent to perform in a particular manner influences dental operators in the selection of armamentarium less than does the urge of personal choice created through training or lack of training. I would discount the thought that operators must employ a wide range of choice for a selection of those devices necessary to success. We must bear in mind that dentists are engaged in the practice of their profession because of particular inherent talent, along with an appropriate intellectual accomplishment. The suggestion that there is a wide range of intellectual difference and variation in digital skill among members of the profession, implying an equally wide range of methods essential to the work of such a group, does not apply as forcefully as among members of an unskilled group, referred to by Mr. Taylor. Modern dental education is standardized along lines that guarantee a more uniform product, and the basic principles upon which such instruction is established makes any pronounced deviation from standard improbable. A quotation by Dr. Thornton states that "Dentists lack training to accomplish results." If such a condition ex-

isted, it is of the past. The future offers much in improvement in higher intellectual attainment, greater technical skill and more definite scientific methods. Modern dental instruction is of such a character and so organized as to eliminate any fear of general deficiency or incapacity among dentists of the future. Not only is dental training standardized, but all schools also are seriously applying themselves to the task of producing agents capable of rendering a high-grade oral service. The young men of today anticipating dentistry as a profession engage in a season of preparation that will produce a group of individuals trained along the same lines who will go out and practice without any great variation from original standards. Dentistry is basically a vocation that requires unusual mechanical skill in the services that it must render. Dental training undertakes to develop this talent in mechanics, which must be of such a character as to adapt itself to the requirements of operative service rather than the effort to dress up each individual's qualifications with new devices. There should be but slight variation in the ability of dentists to proceed along a given line. There must be an appreciable difference in the individual capacity for action even in the most select group, but this should not require a similar variation in instruments used in operating. The quotation from the "American Text Book on Operative Dentistry" is impressive. It reads in part, "Every student should be master of a few instruments and add to that list those that experience demonstrates are necessary and then master those." Simplicity is the essence of success and should be the watchword of all operators. Efficiency is guaranteed through mastery of the devices used. Many of the so-called improvements in dental appliances are not improvements but complications. So far, G. V. Black has arranged the most satisfactory armamentarium yet recommended for use in operative procedures, and has outlined a thorough technic that promises to live far into the future. The great principles enunciated by him will doubtless endure as the basis of any future effort to improve this phase of dental service. A clear and thorough understanding of what to do, a definite method of procedure in carrying out the requirements of operative tasks, a technic acquired through rigid training, coupled with an enthusiasm to administer the exacting demands of the true art and science of dentistry, will subordinate the many obstacles so common to our progress without particular reference to the personal equation involved.

TREATMENT OF INJURIES OF THE UPPER PART OF THE FACE*

By V. H. KAZANJIAN, C.M.G., D.M.D., M.D., Boston, Massachusetts

INJURIES of the upper part of the face vary in character and severity, and may involve the nose, eyes, upper jaw, lips and internal structures, such as the sinuses and nasopharynx. Obviously, in this paper, it will be impossible for me to cover the subject from every angle. Therefore, I shall limit the discussion to injuries to the bone, speaking not only of military, but also of civilian, injuries, as the principles of the treatment are fundamentally the same.

It is true that war injuries present a different picture from those seen in civilian life. In the former, there may be massive laceration of the face, destruction and comminution of different parts. In the latter, laceration of the soft tissues may exist, but it is not usually associated with loss of tissue. Multiple fractures causing distortion of the whole facial contour are quite common. The bones of the upper part of the face most commonly injured are the maxillary, nasal and malar bones.

FRACTURES OF THE MAXILLA

Fractures of the maxilla will be discussed under the following classification: (1) partial fractures; (2) complete fractures; (3) fractures of edentulous cases. These fractures may occur with or without loss of tissue.

This classification, as will be seen later, is based on the mechanical principles covering the manner of fixation of fragments, as each case requires a different type of splint, based on the available point of anchorage.

Partial Fractures.—Under this classification are grouped the various types of fractures which, although differing in severity and extent of injury, have one point in common; that is, a part of the jaw carrying one or more solid teeth is not severed from its position. A mild case may involve one small section, the entire half or a greater part of the maxilla, with little displacement; while an extensive case may show varying degrees of comminution with loss of tissue and laceration of the oral mucosa. The displacement is usually downward and toward the median line.

For immobilization in partial fractures, the most suitable anchorage is the solid part of the jaw carrying one or more teeth. Splints may differ in details of construction, but it is important to have in mind that they are designed to be anchored to this solid portion. We may select one of the following types of splint: (1) an arched wire similar to an orthodontia regulating appliance banding and connecting various teeth and

*Read before the Section on Military Surgery at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

cemented to the teeth (Figs. 1-2); (2) an orthodontia arch with Angle's bands; (3) swaged and cast dentures, fastened over the teeth; (4) a vulcanized jacket plate, which will sometimes meet the requirements; (5) in an emergency, simple corrugated wire bands, to form an arch, and fine wires and silk ligatures, to hold the part in position.

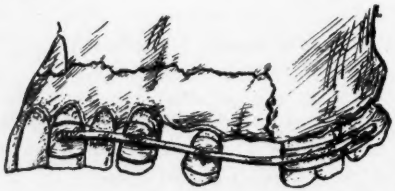

Fig. 1.—Arched wire retaining appliance with bands connecting various teeth.

Where we have comminution and loss of tissue, it is first necessary to clean the wound surgically by removing loose alveolar processes and broken teeth before the bone can be expected to unite. In addition, a certain amount of suturing may be indicated. It is important to add a removable appliance to the splint to act as substitute for the lost tissue. If this is not done, sagging of the lip will take place as the wound heals. This is particularly true in extensive war injuries, since it is much easier to prevent facial deformity than to correct the deformity later. This appliance may be inserted over the raw granulating

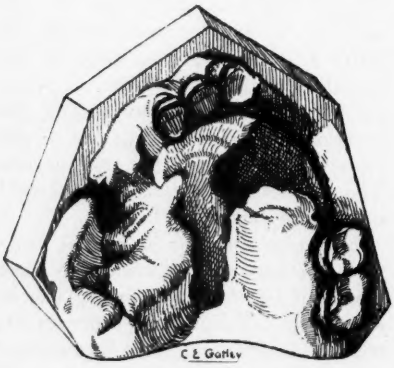

Fig. 2.—Retaining appliance used for comminuted fracture of the upper jaw.

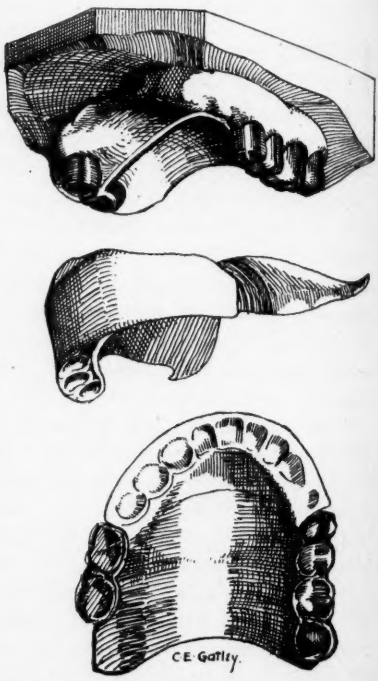

Fig. 3.—Model showing destruction of the maxilla anteriorly, and a fracture of the right molar region. The fracture is immobilized by a band and wire splint cemented to the teeth. The vulcanite baseplate is retained by attachment to the wire of the splint, and has sufficient fullness and contour to prevent undesirable adhesions and contraction of the soft tissues. It also serves later as a supporting appliance in connection with plastic operations.

tissues, and, if accurately made, will not hinder healing of the wound (Fig. 3).

Fig. 4.—Combined headgear and chin piece (made of surgical strapping), exerting pressure by means of elastic bands.

Complete Fracture of the Maxilla.—In complete fracture, the maxilla is entirely separated from its attachments.

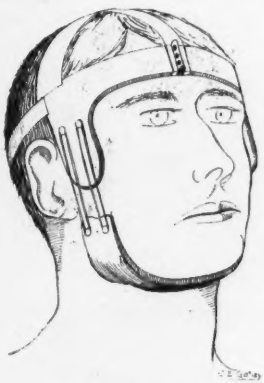

Fig. 5.—Another type of headgear with a guttapercha chin piece molded to the chin and sublingual region, and controlled by a pair of elastic bands at either lateral extremity.

The line of separation may be just above the alveolar process or extend higher up. In severe cases, the nasal and malar bones may be involved. In one case, I was able to detect the fracture line in the supra-orbital region, including the outer plate of the frontal sinuses. The whole upper part of the face was pushed downward at a distance of 1 cm. Upward pressure against the upper teeth raised the whole upper part of the face. The displacement in a complete fracture

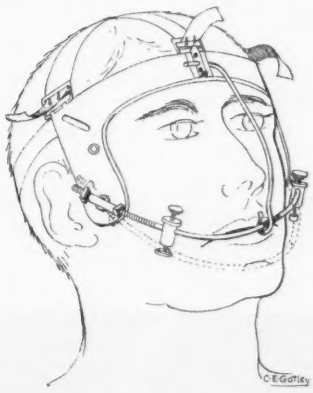

Fig. 6.—Guttapercha fitted to the forehead and temporal regions and retained by a headgear of webbing. The wire arch which passes in front of the face rotates in the holes in front of the ears to allow a wider range of adjustment. In this illustration, the ends of the arch are threaded and pass through small metal tubes (which have short spurs soldered at right angles to permit introduction to the holes in the guttapercha), with nuts to control the length. In other instances, the ends of the facial arch may be bent at right angles to allow direct insertion in the holes. The median wire controls the height of the arch. Any part of the appliance serves as an anchorage of intra-oral splints, and nasal and facial supports.

of the upper jaw is usually downward or even downward and backward. At times, the fracture is so impacted as to

be concealed, thereby delaying detection. In such case, distortion of the facial contour and disturbance of normal occlusion will facilitate in making the diagnosis.

Fig. 7.—Rear view of head gear illustrated in Figure 6, showing method of attaching surgical webbing to retain the appliance in position.

Fig. 8.—The same headgear as in Figures 6 and 7, showing immobilization of nasal and maxilla bones.

Fig. 9.—Kingsley splint supported by guttapercha headgear.

Splints for this type of fracture derive their anchorage elsewhere, the most

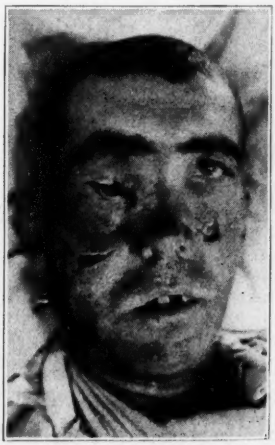

Fig. 10.—Patient suffering from complete comminuted fracture of the maxilla and nasal bones. Elongation of the face is evident.

available location being the forehead. Here, headgears become indispensable, the type being dependent on the character of the injury. In simple cases with but little downward displacement and without loss of occlusal relation, a simple pressure bandage may be made sufficiently effective by pressing the lower jaw against the upper and holding the upper jaw immobile for the time necessary to effect union, as in these cases the bone unites very quickly.

Fig. 11.—Intra-oral splint fastened to the lower anterior teeth exerting pressure against the maxilla by means of the perpendicular wire fastened to the headgear.

On the other hand, extensive injuries with more or less comminution and laceration of tissues require more positive anchorage in the form of a headgear. In order that it may be utilized effectively, a headgear should cover a sufficient areas over the forehead and temporal region to act as a secure anchorage and should fit accurately. Attempts have been made to devise a "ready made" headgear for universal use; but, unfortunately, so far, these have not been very successful; probably, because the headgear would have to be more or less complicated in order to fit every head accurately, and also because it is comparatively simple to make one to fit each particular requirement. I have successfully applied the following types, both during the war and in civilian practice.

If only vertical pressure is needed for the immobilization of the jaw, a headgear made of surgical strapping material, 1 inch in width, is used. This is quickly made with the material always available in the hospital. The pressure should be exerted by means of elastic bands placed at the side of the face, connecting the headgear either to

Fig. 12.—An intermaxillary vulcanite splint made in sections to facilitate introduction and adjustment in the mouth.

a chin-piece or to an intra-oral appliance of the Kingsley type (Figs. 4-5).

While this headgear is useful in a great majority of cases, it is often necessary to apply pressure in other directions as well as vertically. For this purpose, a rigid type of headgear is desirable. During the war, headgears were indispensable for this work and

Fig. 13.—Immobilization of bone fragments held in position by means of fine wires extending from the bone to the headgear.

many types have been devised and used successfully.

I have experimented with different materials for headgears and have found black guttapercha the most satisfactory. The advantages of guttapercha lie in the fact that (1) it is readily shaped to the contour of the head by softening in hot water; (2) it requires little alteration to fit the same headgear to other cases; (3) it is sufficiently rigid to exert the necessary pressure, and (4) as it is plastic material, one is able to make attachments to any part of the headgear. As the necessity arises, any section may be softened with a hot spatula and the attachments embedded. It is not necessary to cover the greater part of the head with guttapercha. The upper half of the forehead and the part of the frontal and temporal regions act as a sufficient brace, and the head-

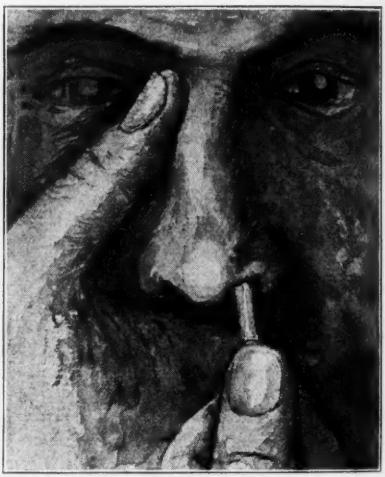

Fig. 14.—Method of reducing simple recent fractures of the nasal bones.

gear is held in position with surgical strapping as shown in the diagrams (Figs. 6-8).

Having the above-described external appliance ready, we have a choice of two methods for the immobilization of the jaw. The first method is to construct an intra-oral splint which is fastened over the upper teeth with arms extending from the corners of the mouth parallel to the side of the face, similar to Kingsley's appliance, and extending the elastics from the appliance

to the headgear (Fig. 9). The second method is to force the lower jaw against the upper by means of a chin-piece or intra-oral appliance fastened to the lower jaw (Figs. 10-11). On the whole, the latter principle, that is, forcing the lower jaw against the upper, is more desirable in many cases because, with this method, one is able to keep the occlusal relation of the teeth accurately. In case of backward displacement of the fragment, it is necessary to have a means of exerting forward tension. This may be done by using intermaxillary elastics extending from the molar region of the upper jaw to the cuspid region of the lower jaw.

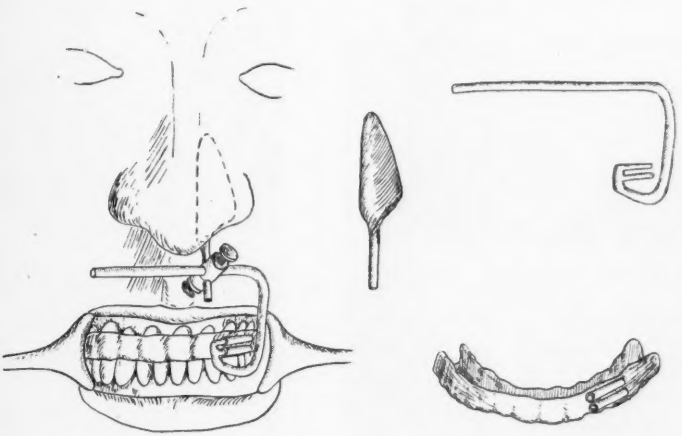

Fig. 15.—Nasal splint deriving anchorage from the upper teeth.

Complete Fracture With Loss of Tissue and Comminution.—Not uncommonly, the greater part of the maxilla is missing in gunshot wounds, and, in addition, there is involvement of the maxillary sinuses and ethmoidal cells. In such cases, it is important to control infection, to operate and remove any loose spicula of bone and shattered teeth, etc., and to establish adequate drainage for the sinuses, as continued suppuration is a frequent occurrence. Whether or not laceration of the lips and cheek is present, it is important to make an appliance that will substitute for the missing bone. This appliance is most conveniently made of vulcanized rubber in the form of a dental plate and fastened to the end of the splint or to the teeth. It will support the facial soft tissues and prevent displacement, and, in the event of plastic operation for the reconstruction of the lip, it will maintain the contour of the newly formed part. The disregard of this principle during the World War has been the cause of many deformities necessitating further operations.

EDENTULOUS CASES

Under the first two classifications, we have, for immobilization, methods based on the assumption that there are a sufficient number of serviceable teeth for anchorage. In edentulous cases, we

have not that means of fixation available. However, the splint should be designed to (1) maintain the relation of the upper and lower jaws, and (2) exert pressure extra-orally, to hold the parts in position. For the preservation of the relation of the upper and lower

Fig. 16.—Splint shown in Figure 15.

Fig. 18.—Nasal splint attached to teeth (mouth closed).

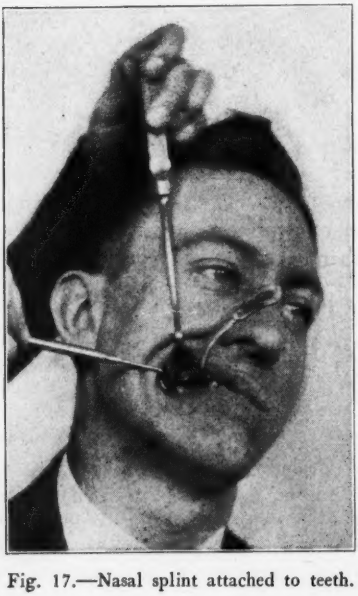

Fig. 17.—Nasal splint attached to teeth.

Fig. 19.—View of patient showing depressed fracture of the malar bone, right side.

jaws, one can utilize the artificial dentures of the patient with some modifications; if that is not possible, an interdental splint should be constructed. This splint is usually made of vulcanized rubber and may be constructed in sections similar to vulcanized occlusal plates. (Fig. 12). In addition, it is necessary to exert pressure extra-orally to

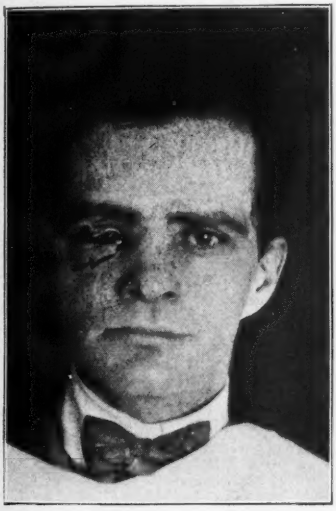

Fig. 20.—Recent fracture of malar bone with the zygoma displaced outward.

force the upper and lower jaws together. For this purpose, and of the methods outlined above for complete fractures are applicable (Figs. 9-11).

In case of destruction of tissue, the same surgical principles hold good in this as well as in other cases. In exceptional cases, when the patient is suffering extensive laceration of the face with a good exposure of bone externally, I have utilized a headgear as an anchorage, to which the loose fragments of bone were suspended by means of fine wires extending from the bone to the headgear (Fig. 13).

INJURIES TO THE NASAL BONE

Simple fractures of the nasal bone, resulting in its depression or deviation to one side, are quite common in civilian practice. These are easily corrected immediately after injury by introducing a flat spatula in the nose and forcing the bone to its normal position (Fig. 14).

Fig. 21.—Reduction of simple fracture of malar bone.

Ordinarily, these cases do not require further treatment. On the other hand, extensive comminution of the nasal bones with a good deal of destruction of various parts has been a common occurrence in military surgery. Whether or not these cases require further plastic operations, it is essential that the remaining parts be preserved and held in as nearly normal position as possible. For that reason, operative treatment combined with the use of a splint is desirable.

The most positive nasal splint derives

its anchorage from the upper teeth. Figures 15-17 give two types readily applied. It sometimes happens that the upper jaw, being also fractured or edentulous, will not act as sufficient anchorage. In that case, a rigid headgear with attachments to go into the nose or against the side of the nose is

Fig. 22.—Mobilization of malar bone by means of a wire hook connected by elastic bands to the perpendicular wire extending from the guttapercha headgear.

the most suitable means to employ (Figs. 6-8).

FRACTURE OF THE MALAR BONES

In multiple injury of the facial bones, a fracture of the malar bone is frequently overlooked, because the soft tissues of the face become inflamed soon after injury and conceal the distortion caused by displacement of the zygoma and infra-orbital region, and, as this bone tends to unite readily, the deformity becomes apparent only with the disappearance of the inflammation. This deformity manifests itself in two ways: 1. A depression is left under the eye, which tends to lower the eye and frequently drops the eyeball to a lower

Fig. 23.—Wire loop attached to malar bone.

level. As a result the patient suffers diplopia on looking upward, in addition to the deformity. There is also a depression over the upped eyelid. (Fig 19.) 2. If the zygoma is pushed out of its position, there is exaggerated prominence of this bone (Fig. 20).

Most fractures of the malar bone are simple fractures. Involvement of the soft tissues is easily diagnosed by placing the index finger on each orbital

ridge and palpating the region. There is invariably a depression and a difference of contour on the fractured side of the face as compared with the normal side. In addition, there is also conjunctival hemorrhage. Bone injuries in that region are at times comminuted even if there are no external wounds. Indeed, it is not uncommon to see the outer wall of the antrum comminuted,

Fig. 24.—Headgear with extended metal arm, pressing the guttapercha pad against the zygoma. Pressure is regulated by the use of elastics adjusted on hooks from the metal arm to the headgear.

filling the entire cavity with a blood clot, which is readily infected and leads to complications.

TREATMENT

Simple fractures are reduced with comparative ease soon after injury by grasping the infra-orbital ridge with a double hook instrument and manipulating it to its normal position (Fig. 21). Usually, no further treatment is necessary, as approximate contact with the solid bone holds the fragments in position. In comminuted fractures, we are forced to use more radical measures.

For a long time, it has been my custom to expose the antrum through the canine fossae and remove loose comminuted fragments; clean the sinuses of blood clots; make an intranasal opening for drainage, and, after reducing the fracture, pack the sinus cavity with iodoform gauze lined with a rubber dam, and leave it for a few days. This method, while it minimized the deformity, was not altogether satisfactory as packing did not afford a sufficiently solid anchorage. Later, I adopted the following method, which gives absolute control of the fracture.

After surgical treatment of the case as outlined above, a small hole is drilled in the bone at a convenient location just below the infra-orbital ridge. This is readily done with either a dental drill or a hand drill through the opening at the canine fossae. A small wire (No. 25) is passed through the hole and is pushed through the skin just below the lower eyelid. The ends of the wire now being on the surface of the skin are bent to make a hook. A guttapercha headgear is applied to the forehead and from this headgear a heavy perpendicular wire (No. 8) (Figs. 22 and 23) extends down over the face. Small elastic bands connect the wire hooks over the skin in such a direction as to apply a pull upward and outward. This causes a constant tension and holds the fragments in position. Usually, it is not necessary to leave this appliance in position more than two weeks. After that time, the wire loop, attached to the bone, is pulled out. It has been

found that there is hardly any irritation to the soft tissues with this method. Of course, if there is an external wound, as in the case of war wounds, the application of the method is made more simple, the operator working through the opening of the wound.

Outward displacement of the zygoma is reduced by pressure. This also is more conveniently done by using a rigid type of headgear as anchorage. A headgear with an arm extending over the projecting zygomatic arch is applied to push the arch into position. This arm is attached to the headgear in the frontal region and has elastic bands at the middle part which exert constant pressure on the zygoma. (Figs. 22 and 24).

REPORT OF CASE

Dec. 25, 1925, while driving an automobile, the patient, aged 20, ran into an electric pole and struck his face on the steering wheel. The hospital examination showed the following injuries: penetrating wound of the right eye; multiple fractures of the bones of the upper half of the face, including depressed fracture of the nasal bones; comminuted fracture of the right malar bone with pronounced depression at the infra-orbital region; abnormal prominence of the right zygoma; complete fracture of the maxilla with pronounced downward displacement. The entire face was elongated, so much so that upward pressure on the upper teeth caused the face to lift for a distance of 2 cm. There was also comminution of the alveolar processes, with destruction of the upper anterior teeth. In spite of the extent of the injuries, the patient's physical condition was remarkably good. The pulse and temperature remained within normal limits throughout hospitalization.

December 31, splints were applied without anesthesia, in order to immobilize the upper jaw. For this purpose, a headgear and chin-piece were connected with elastic bands to force the mandible against the maxilla. In the meantime, the upper and lower teeth were brought to normal contact with intermaxillary elastics.

Jan. 4, 1926, under ether anesthesia, the left eye was enucleated. In the meantime, an attempt was made to reduce the right malar fracture by external manipulation, but the fragments, being very loose, could not be maintained in position. The right maxillary sinus was opened through the canine fossae. The external wall of the antrum was found to be comminuted, with fragments driven into the antrum. These loose fragments, as well as clotted blood, were removed from the antrum, and drainage was established through the nasal route. From a drilled hole in the malar bone, a piece of wire was passed through the skin of the cheek. This wire was connected to the headgear with elastic bands (Figs. 22 and 23).

January 7, pressure was applied to the right zygomatic arch by means of a metal bar and a guttapercha pad placed over the zygomatic prominence (Fig. 24).

January 10, the zygomatic pressure pad was removed.

January 20, the wires connected with the malar bone were removed.

January 26, the patient was discharged with complete union of the fractures. No attempt was made to reduce the nasal fracture as the external contour was good.

NUTRITION AND TEETH*

By B. ORBAN, M.D., Vienna, Austria

IN the last few years, there has been much work done on the subject of nutrition in relation to the teeth, in the United States, for the most part.

It is a well-known fact that the incisors of the albino rat make a continuous growth and it is remarkable that nothing has been said about the celerity of growth in relation to diet.

Our experiments[1] have been made on 280 albino rats, fed with different kinds of food, namely, wheat, starch, rice and so on. I shall speak only about the group that was fed on wheat. In addition to wheat, we have given them different kinds of nutritive stuffs and have noted the celerity of the growth of the incisors and also have made microscopic examinations.

Normally, the incisors grow, on an average, from 2 to 3 mm. weekly. The upper incisors grow more slowly than the lower. In Figure 1, the growth of the incisors in six weeks on different diets is shown. In the first column, we see the growth of the incisors in rats fed with wheat, meat and green leaves of cauliflower.

In a next column, we see the growth of the incisors of rats fed with starch. Rats fed on starch can live from four to six weeks while loosing weight. The incisors grow more slowly than in those that are fed on wheat, meat and green leaves. With even the poorest diet such as starch, the growth of the incisors never stops. In the next column, the growth of the incisors in rats from which the parathyroid has been removed is shown. There is, similarly, a retarded growth of the incisors in these cases as with the rats fed on starch. It is an interesting fact that the incisors of rats fed on milk grow more slowly than those of rats fed on wheat, meat and green leaves, and almost as slowly as those of rats fed on starch. On a milk diet, no increase of body weight takes place, but the calcification of the incisors is, as I shall show later, excellent.

Rats fed only on wheat live long, but they do not thrive. There is only a slight increase of body weight. Figure 1 shows the growth of the incisors of these rats.

To wheat, we added different types of nutritive substances, among these,

*From the Histologic Laboratory (superintendent, Dr. B. Gottlieb) of the Dental Institute (director, Prof. Dr. R. Weiser) and from the Physiologic Institute of the University of Vienna (director, Prof. Dr. A. Durig).

*Read before the Section on Anatomy, Physiology, Materia Medica and Therapeutics at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

1. The experiments were made with Dr. J. Köhler.

cod-liver oil, which is known as the representative of the fat-soluble vitamin. A decided growth of the teeth was evident. It is remarkable that the incisors of rats fed on pork fat and wheat show a similar increase of growth. Body growth is greater in rats fed on cod-liver oil than in those fed on fat. There is a greater difference in the bodily growth than there is in the growth of the incisors. Therefore we can say that the growth of the incisors does not depend on the same factors as does the growth of the body.

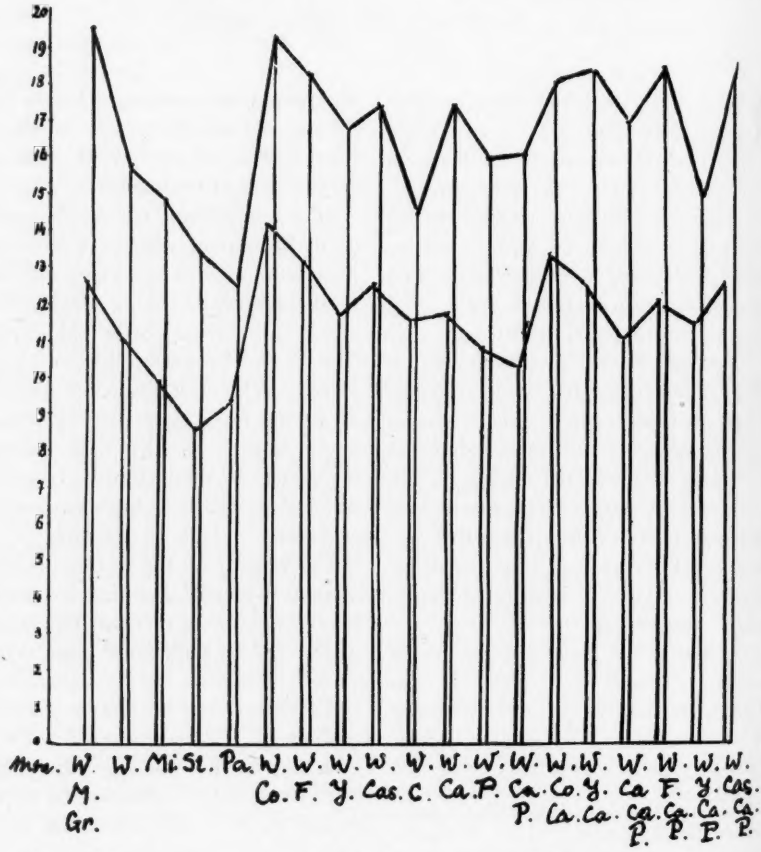

Fig. 1.—The average growth of the incisors of rats on different diets. W, wheat; M, meat; Mi, milk; St, starch; Pa, animal deprived of parathyroid; Co, cod-liver oil; F, fat; Y, yeast; Cas, casein; Ca, calcium; C, lemon juice; P, phosphorus; Gr, green leaves. The first line in every column shows the growth of the upper incisors; the second, the growth of the lower incisors.

With other rats, we have added to wheat water-soluble vitamin B in the

form of yeast, and it may be seen that the incisors have grown more rapidly. We believe that this rapid growth is due to the protein in yeast. With rats fed on casein, which is pure protein, the growth of the teeth is just as rapid as with those fed on yeast.

Water-soluble C vitamin gives no changes in growth of the incisors.

If to wheat we add calcium, the incisors grow more rapidly than with wheat alone. If, instead of calcium, we add phosphorus, no increase of growth takes place.

In cases in which calcium and phosphorus, in equal parts, were added to wheat and cod-liver oil or to wheat and fat, the increase of growth was best in those rats fed with fat. When calcium and phosphorus were added to wheat and yeast or wheat and casein, the growth of the incisors was better in the latter case.

We have seen that the growth of the incisors is less influenced by the accessory food factors than is body growth.

Now I am going to show how the quality of the tooth substance is influenced by various food factors.

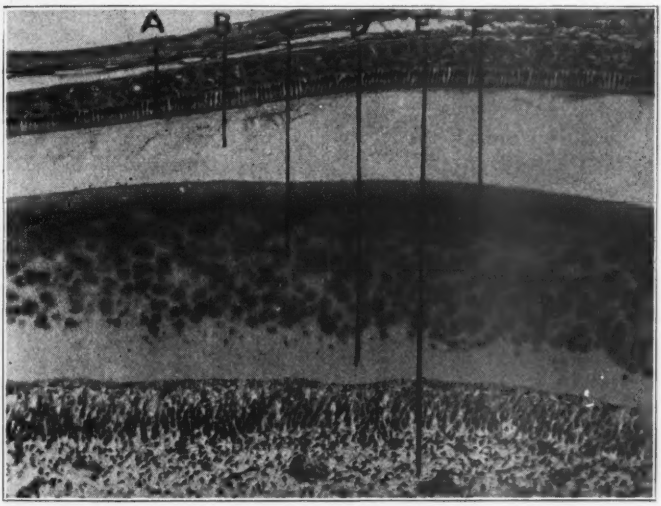

Fig. 2.—Cross-section of an incisor of a rat fed on a wheat diet. The growth of the upper incisors was 11 mm., of the lower, 15.8 mm., in six weeks. The calcification of the dentin is insufficient. There are many interglobular spaces. The dentinoid is broadened. Only the outer part of the dentin is homogeneously calcified. The body weight before the experiment was 90 gm.; after, 97 gm. In Figures 2-18, *a* indicates enamel epithelium; *b*, enamel; *c*, dentin; *d*, dentinoid; *e*, dentinal pulp; *f*, "manteldentine."

Figure 2[2] shows a cross-section of the incisors of a rat fed with wheat; Figure 3, of a rat fed with milk. There are remarkable differences in the calci-

2. The photomicrographs were always made from the same part of the labial side of the upper incisors.

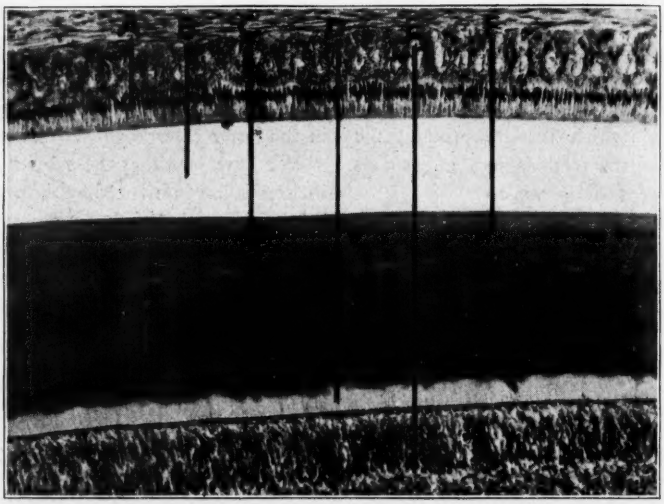

Fig. 3.—Cross-section of an incisor of a rat fed on milk. In six weeks, the upper incisors grew 9.8 mm., the lower, 14.7 mm. The calcification of the dentin is very good. The dentinoid is small. The body weight before the experiment was 135 gm.; after, 120 gm.

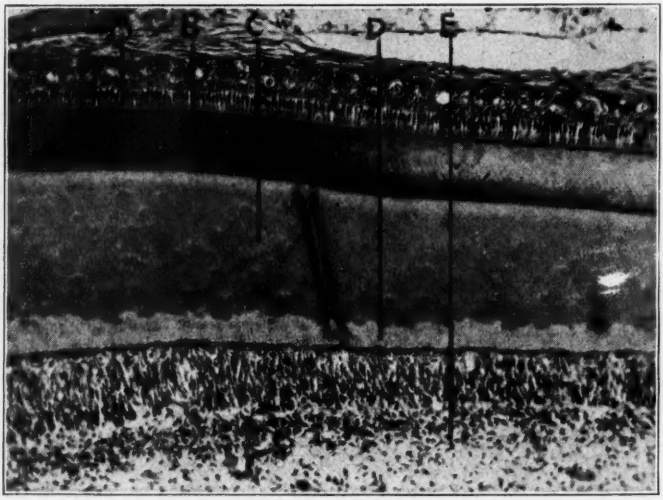

Fig. 4.—Cross-section of an incisor of a rat fed on wheat and cod-liver oil. Growth of the incisors, in six weeks: upper, 14.1 mm.; lower, 19.3 mm. There was good calcification of the dentin, and normal dentinoid. Body weight before the experiment, 90 gm.; after, 118 gm.

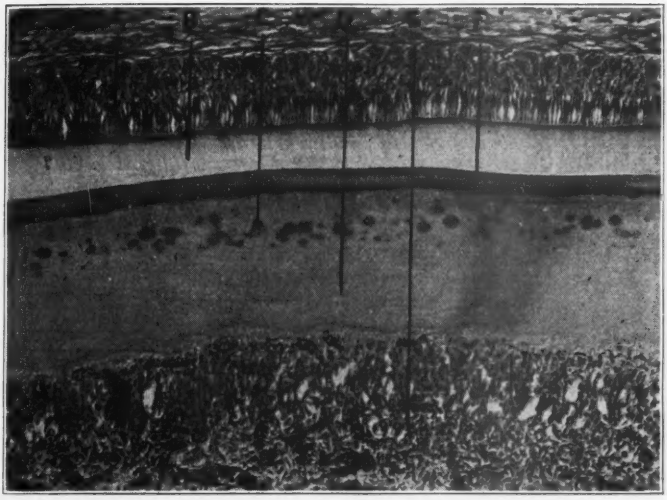

Fig. 5.—Cross-section of an incisor of a rat fed on wheat and yeast. Growth of the incisors in six weeks: upper, 11.9 mm.; lower, 16.9 mm. The calcification of the dentinoid was very poor, and almost the whole dentin is uncalcified. Only the "manteldentine" (*f*) is calcified. Body weight before the experiment, 63 gm.; after, 93 gm.

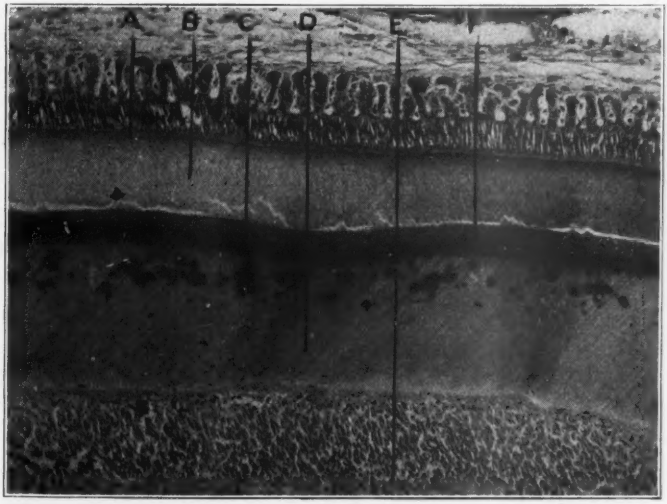

Fig. 6.—Cross-section of an incisor of a rat fed on wheat and lemon juice. Growth of the incisors, in six weeks: upper, 11.5 mm.; lower, 14.4 mm. Incomplete calcification of the dentin resembling that in the animal fed on wheat and yeast was present. Body weight before experiment, 100 gm.; after, 115 gm.

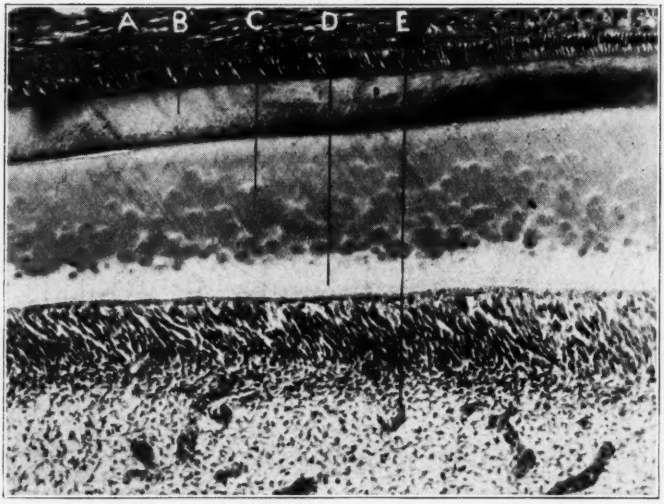

Fig. 7.—Cross-section of an incisor of a rat fed on wheat and pork fat. Growth of the incisors, in six weeks: upper, 13.5 mm.; lower, 18.2 mm. The calcification of the dentin is almost as good as with rats fed on wheat and cod-liver oil. The body weight before the experiment was 95 gm.; after, 105 gm.

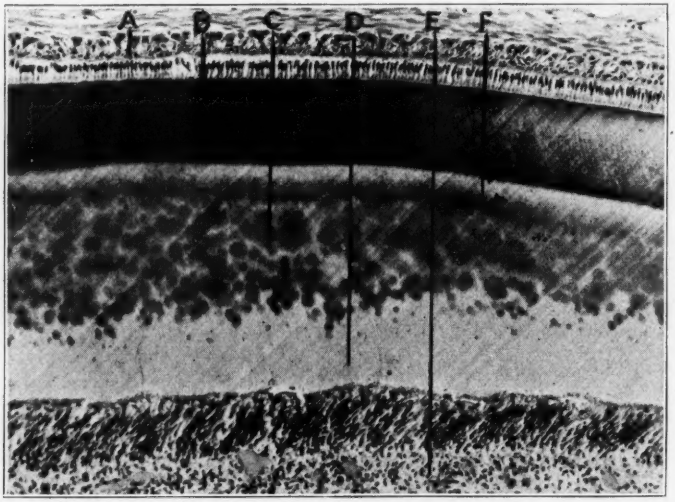

Fig. 8.—Cross-section of incisor of a rat fed on wheat and casein. The growth of the incisors in six weeks: upper, 12.5 mm.; lower, 17.4 mm. The calcification of the dentin is better than with rats fed on wheat and yeast. Body weight before the experiment, 100 gm.; after, 108 gm.

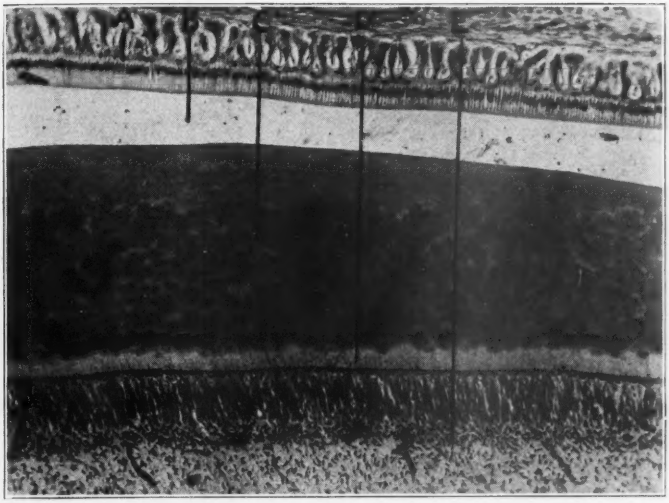

Fig. 9.—Cross-section of the incisor of a rat fed on wheat and calcium (carbonicum). Growth of the incisors: upper, 11.8 mm.; lower, 17.4 mm. Good calcification of the dentin was present. There are only small interglobular spaces. Body weight before the experiment, 105 gm.; after, 120 gm.

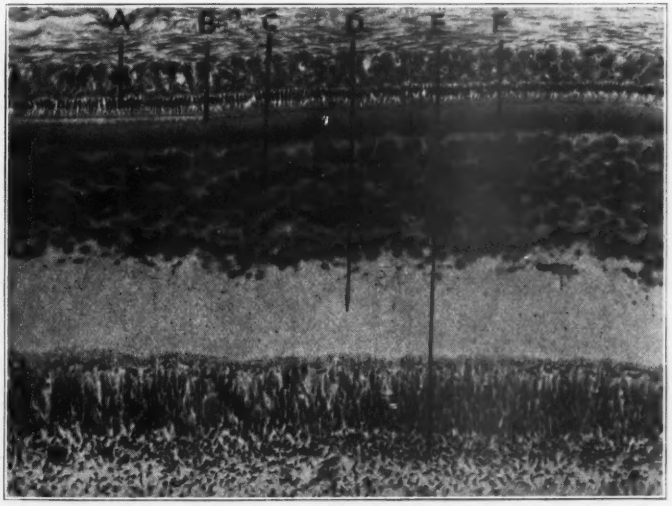

Fig. 10.—Cross-section of incisor of a rat fed on wheat and phosphorus. Growth of the incisors in six weeks: upper, 10.1 mm.; lower, 16.0 mm. The calcification of the dentin is not so good as with rats fed on wheat and calcium. The interglobular spaces are larger and the dentinoid is broadened. The space of the enamel (*c*), lost by decalcification, has disappeared by shrinkage. Body weight before the experiment, 105 gm.; after, 145 gm.

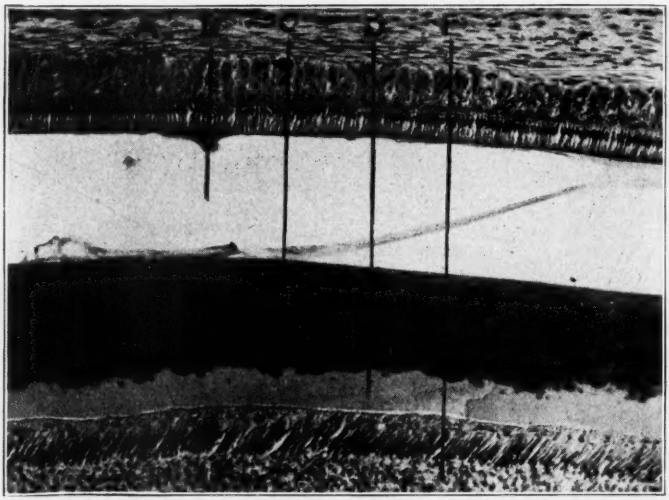

Fig. 11.—Cross-section of an incisor of a rat fed on wheat, calcium and phosphorus. Growth of the incisors, in six weeks: upper, 11.4 mm.; lower, 16.2 mm. There was good calcification of the dentin, but the dentinoid layer is broadened. Body weight before the experiment, 120 gm.; after, 130 gm.

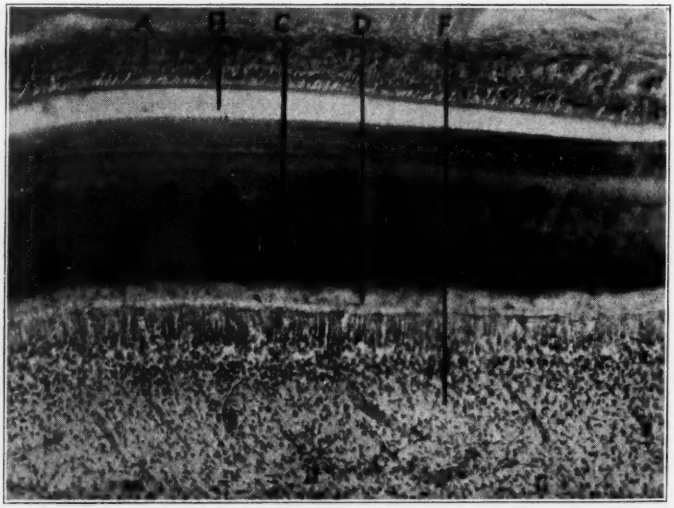

Fig. 12.—Cross-section of an incisor of a rat fed on wheat, cod-liver oil and calcium. Growth of the incisors, in six weeks: upper, 13.4 mm.; lower, 18.1 mm. There was very good calcification of the dentin. Body weight before the experiment, 70 gm.; after, 120 gm.

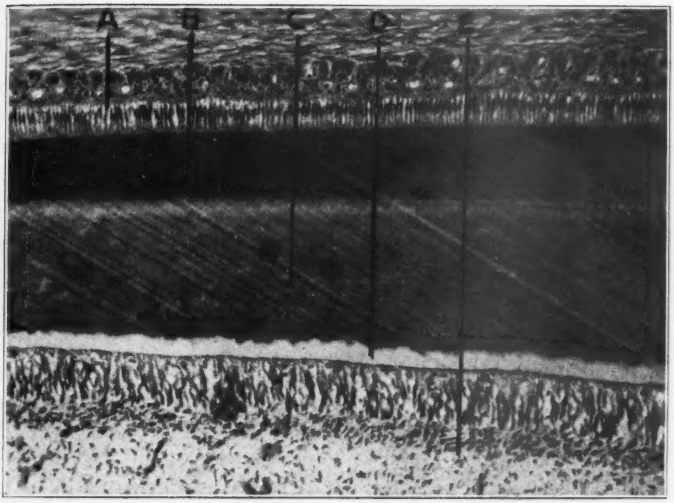

Fig. 13.—Cross-section of an incisor of a rat fed on wheat, cod-liver oil, calcium and phosphorus. Growth of the incisors, in six weeks: upper, 11.2 mm.; lower, 17.2 mm. There was very good calcification of the dentin. Body weight before the experiment, 105 gm.; after, 150 gm.

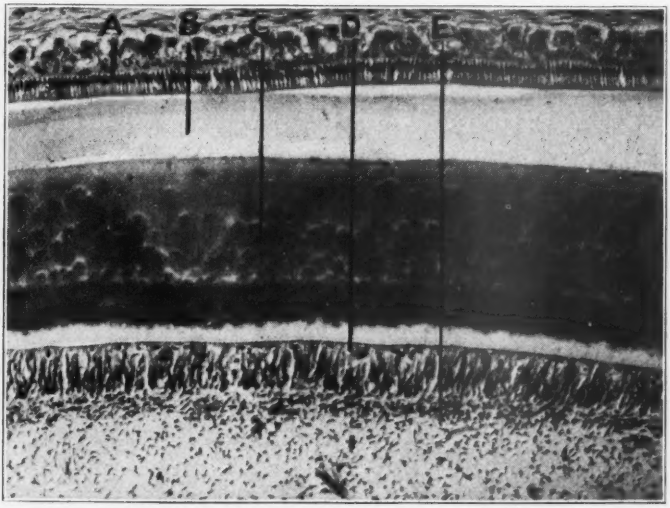

Fig. 14.—Cross-section of an incisor of a rat fed on wheat, fat, calcium and phosphorus. Growth of the incisors, in six weeks: upper, 12.2 mm.; lower, 18.7 mm. There was good calcification of the dentin, similar to that with wheat, cod-liver oil, calcium and phosphorus. Body weight before the experiment, 120 gm.; after, 135 gm.

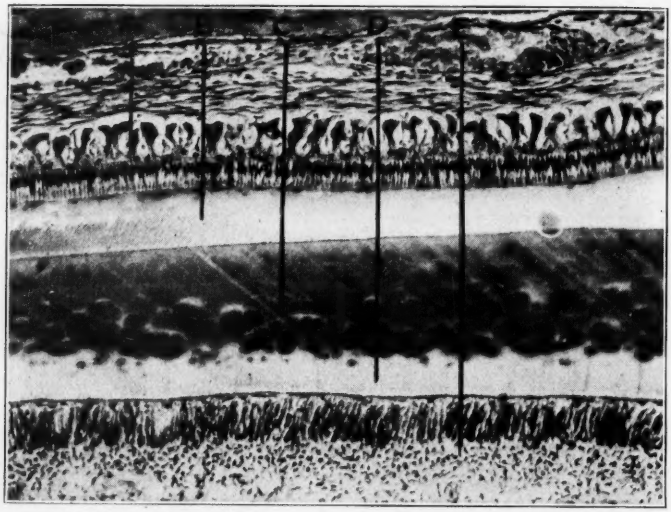

Fig. 15.—Cross-section of an incisor of a rat fed on wheat, yeast and calcium. Growth of the incisors, in six weeks: upper, 12.2 mm. 1; lower, 18.5 mm. The calcification of the dentin is better than in rats fed on wheat and yeast alone. Body weight before the experiment, 120 gm.; after, 120 gm.

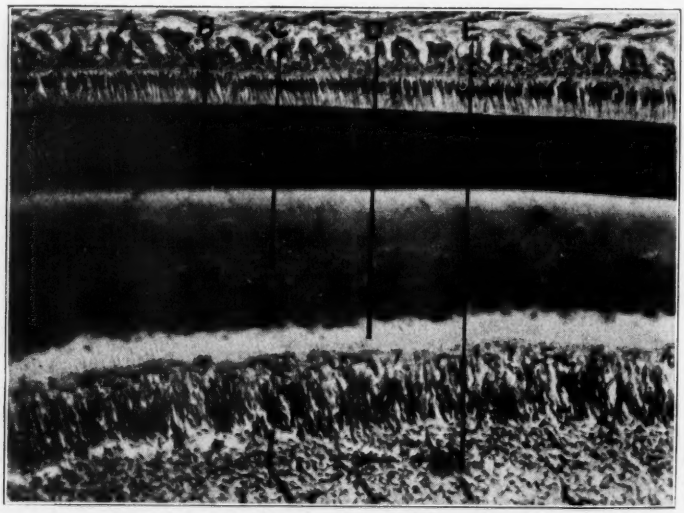

Fig. 16.—Cross-section of an incisor of a rat fed on wheat, casein, calcium and phosphorus. Growth of the incisors: upper, 12.7 mm.; lower, 18.4 mm. There was good calcification of the dentin, a little better than with wheat, yeast, calcium and phosphorus. Body weight before the experiment, 110 gm.; after, 150 gm.

cation of the dentin. The dentin of the rat fed with wheat shows poor calcification and a broadened dentinoid and interglobular spaces. Only the outer part of the dentin, the *manteldentine* (Weirenreich), is homogeneously calcified. The dentin of the incisor of the rat fed with milk shows good calcification with normal dentinoid.

Figure 4 is a section of the incisor of a rat fed with wheat and cod-liver oil. The calcification of the dentin is good. The fourth rat (Fig. 5), which was fed with wheat and yeast, shows very poor calcification, almost the whole dentin being uncalcified. The *manteldentine* is homogeneously calcified. Later, I am going to demonstrate the cause of the good calcification of the *manteldentine*. Figure 6 shows the incomplete calcification of the dentin of a rat fed with wheat and lemon juice.

In Figure 7, a comparison between wheat-cod liver oil and wheat-fat diets is made. The calcification of the dentin in rats fed on wheat and fat is better than in rats fed on wheat alone, and almost as good as with a wheat and cod-liver oil diet.

Figure 8 shows the calcification in rats fed on a wheat-casein diet. Casein diet is better for the calcification than yeast.

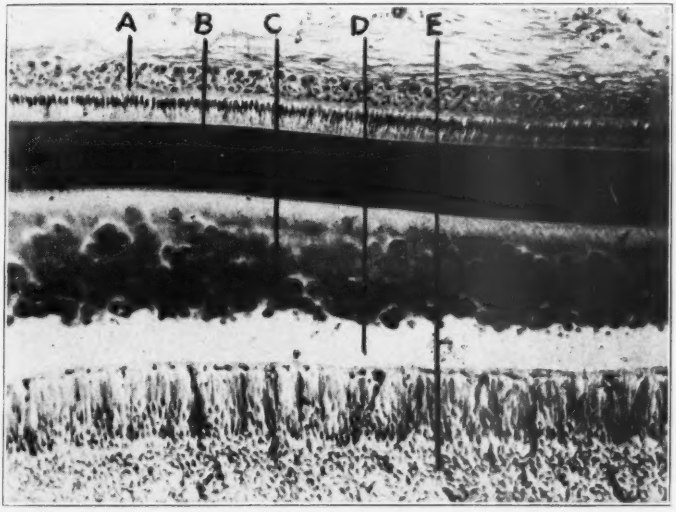

Fig. 17.—Cross-section of an incisor of a rat fed on wheat, yeast, calcium and phosphorus. Growth of the incisors: upper, 11.6 mm.; lower, 15.2 mm. The calcification is better than in rats fed on wheat and yeast alone, but not quite so good as in rats fed on wheat, casein, calcium and phosphorus. Body weight before the experiment, 120 gm.; after, 170 gm.

Figure 9 shows the calcification of the dentin of rats fed on wheat and calcium; Figure 10, of rats fed on wheat and phosphorus; Figure 11, of rats fed on wheat, calcium and phosphorus. The best results with regards to calcification are attained with

wheat and calcium. A wheat and phosphorus diet does not give such good results. A wheat, calcium and phosphorus diet gives a homogeneous calcification, but the dentinoid is broadened.

Figure 12 shows the results of calcification in rats fed on a wheat and cod-liver oil diet, to which we added either calcium (Fig. 12) or calcium and phosphorus. (Fig. 13.) With the wheat-fat diet, we have also given calcium and phosphorus (Fig. 14), and we can see that the calcification is not worse than with the cod-liver oil diet.

Figure 14 shows the calcification of the incisors of rats fed on wheat-yeast-calcium diet. Figures 16-17 show the calcification of the dentin of rats fed on wheat-casein-calcium-phosphorus, and in a wheat-yeast calcium-phosphorus diet. It may be seen that the calcification on casein diet is as good as on a yeast diet.

Figure 18 is from a rat from which the parathyroid gland had been removed. The enamel epithelium is destroyed. There is enamel only on some parts in the form of drops. The dentin is poorly calcified and shows a better calcification only opposite the enamel drops. This case shows that the calcification of the outer part of the dentin of the *manteldentine* depends on the presence of enamel, and therefore, also, with the poorest calcification of the dentin, the outer layer shows a homogeneous calcification.

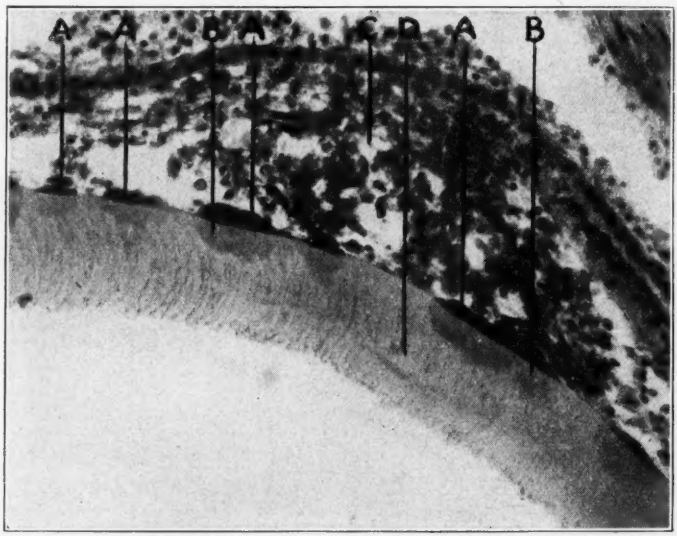

Fig. 18.—Cross-section from the labial side of the incisor of a rat from which the parathyroid had been removed. The enamel epithelium (*e*) is destroyed. Enamel (*a*) is only on the same parts built up in the form of drops. The dentin is poorly calcified (*d*) and shows a better calcification only opposite the enamel drops (*c*). This case shows that the calcification of the outer part of the dentin ("manteldentine") depends on the presence of enamel.

MILITARY SURGERY IN PEACE TIME*

By ROBERT H. IVY, M.D., D.D.S., F.A.C.S., Philadelphia, Pennsylvania

DURING the late war, the Surgeon General of the Army, by the creation of the plastic and oral or maxillofacial section, made provision for the more efficient care of cases of injury or disease of the face, mouth and jaws. This measure consisted in the formation of groups of surgical specialists, dental surgeons and prosthetists, with their necessary equipment in certain hospitals in the advanced zone, the base section and the home country. The success of this plan as regards war cases has justified its continuance in a more limited degree for the care of service and exservice men suffering from injuries and diseases of the maxillofacial region, not necessarily of war origin. To the Walter Reed General Hospital in Washington are sent a great many important transportable surgical cases from army organizations located in the eastern part of the United States. There are also admitted many patients from the Veterans' Bureau, who are entitled to treatment for any medical or surgical condition, whether or not of war origin. Among all these cases is naturally found a considerable number coming under the maxillofacial classification. To give a general idea of the number and types of cases handled by this service, the following is a brief summary of the work done in 1924: total number of maxillofacial cases treated, 40; officers, 8; enlisted men, 21; Veterans' Bureau patients, 11; operative treatments, 22; oral and dental surgical treatments, 18; roentgen-ray and radium treatments, 9.

There were four cases of bone grafting for repair of defect of the mandible resulting from fracture; and there were four cases in which plastic repair was carried out for traumatic defects, with missing substance of soft tissues of the face, nose, ears and lips. There were two cases of excision of branchial cyst, one of submaxillary cyst, one of dentigerous cyst. There were five cases of operative removal of papillomas and nevi of the skin of the face. There were three cases of operative removal of an epithelioma of the lower lip, followed or preceded by roentgen-ray therapy of the submental and submaxillary regions. There was one case of bone graft for a traumatic skull defect. There were six cases of malignant neoplasm of face, parotid, maxilla or mandible, in which operation was contraindicated, and which were treated by radium or deep roentgen-ray therapy. Three of the patients improved remarkably, the condition of two remained apparently stationary and one died. There were fifteen cases of fracture of the mandible or the maxilla, or traumatic intra-oral defects in which the dental officers reduced fractures,

*Read before the Section on Military Surgery at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

and applied intermaxillary wiring, and splints, dentures or other prosthetic appliances.

REPORT OF CASES

CASE 1.—C. F. C., a private, was admitted, April 4, 1921, suffering from chronic osteomyelitis of the left side of the mandible. The condition started with a dental abscess, the tooth having been extracted, Jan. 23, 1921. Swelling of the left side of the face continued, with discharge of pus into the mouth and through external incisions. May 17, 1921, a large sequestrum was removed from the left side of the mandible. As soon as it was determined that pathologic fracture was inevitable, cast metal splints were inserted to maintain the proper relationship of the upper and lower teeth. Treatment by maintaining drainage was continued, and small sequestra were removed from time to time, until by March, 1922, all suppuration had ceased. It was noted, in May, 1922, that a considerable portion of the bone had regenerated, but that a small defect of about 1.5 cm. remained. This required a bone graft, and, May 20, three strips of osteoperiosteum from the tibia were inserted between the fragments after the latter had been thoroughly exposed and freshened. (The technic of bone grafting for the mandible has been described in detail.[1]) A radiogram, taken Dec. 20, 1922, shows bone consolidation complete. The splints were then removed. Occlusion of the teeth after operation was good.

CASE 2.—R. S., a discharged soldier, was admitted, Feb. 4, 1924, with a healed defect in the symphysis of the mandible resulting from gunshot fracture with loss of substance, received in action, June 25, 1918. He had been discharged with the ununited fracture, wearing a splint to maintain approximate relationship of the bone fragments. The defect in the symphysis measured about 2 cm. It was found possible to use the original splint by wiring it to the upper teeth, and, Feb. 19, 1924, an osteoperiosteal graft from the tibia was applied. Three months later, consolidation was proceeding satisfactorily After union was complete, a prosthetic appliance was furnished to supply the missing teeth.

1. The Medical Department of the United States Army in the World War, Vol. 11, Pt. 2.

CASE 3.—J. S., a discharged soldier, from August, 1918, had suffered from an abscessed tooth in the lower jaw, followed by successive "abscesses" of several lower teeth, and in December, 1919, he had a portion of the bone removed. Curettage was performed at succeeding intervals, and an appliance was placed on the teeth to maintain the relationship of the remaining bone fragments. On admission to the Walter Reed General Hospital, June 22, 1922, there was a healed defect of the symphysis and lateral portions of the mandible, extending to the molar region on each side. The right stump contained one molar and the left, two. This permitted the insertion of a metal splint, consisting of caps on the molars, connected by a curved bar across the symphysis defect. June 22, 1922, a bone graft from the crest of the right ilium was inserted, being fastened to the mandibular fragments by silver wires. Radiograms, made March 1, 1924, showed satisfactory consolidation.

CASE 4.—A. L., a discharged soldier, in February, 1918, developed an abscess of two lower teeth, for which, owing to activities at the Front, he was unable to get treatment. Osteomyelitis followed. In February, 1920, the patient stated, he had a large sequestrum removed from the right side of the mandible, and a bone graft from the tiba was inserted at the same time. Two months later, the graft had to be removed because of infection. Following this, there was a discharging sinus, until Nov. 1, 1921. On admission to Walter Reed General Hospital, Feb. 9, 1922, there was a defect in the right side of the mandible from the mental foramen to the third molar, which was present in the posterior fragment. A cast metal splint was made. The upper section had an extension fixed to the lower molar in the right fragment, and the left lower section of splint had a jackscrew to draw the long mandibular fragment into position, after which fixation was maintained by means of a lockpin connecting it with the upper portion of the splint. After reduction, May 9, 1922, a bone graft from the crest of the right ilium, 6 cm. in length, was inserted to fill the mandibular defect. A radiogram, taken Feb. 30, 1925, almost three years later, showed the graft firmly united at both ends.

CASE 5.—J. A. W., captain in the cavalry, was thrown from a horse, April 4, 1924,

sustaining a compound comminuted fracture of the left side of the mandible in the region of the mental foramen; fracture of right ascending ramus, and a severe lacerated wound of the lower lip. The fracture on the right side united without trouble. That on the left side was accompanied by much suppuration and exfoliation of dead bone. The patient was admitted to Walter Reed General Hospital, May 4, 1924, presenting a healed adherent scar of the lower lip near the left corner of the mouth and an ununited fracture of the mandible in the left mental foramen region, with about a 4 cm. loss of substance. A cast metal splint was made, the upper and lower segments being connected by wire ligatures passed over hooks. After infection and sequestrum formation had cleared up, Oct. 7, 1924, a bone graft from the crest of the ilium was inserted. A radiogram, taken April 11, 1925, showed complete consolidation.

CASE 6.—L. S., a discharged soldier, suffered compound comminuted fractures of the mandible, in an automobile accident, Dec. 9, 1924. On the right side, the fracture extended behind the third molar to the angle. On the left, the fracture passed through the second molar region to the lower border, leaving the third molar in the posterior fragment. On admission, Dec. 17, 1924, there was marked suppuration on both sides. An attempt was made on another service to fix the fragments with silver wire bone sutures, but these had to be removed later owing to infection. Cast metal upper and lower splints were made, and the case was treated by drainage and removal of sequestra from time to time. By August, 1925, all suppuration had ceased, and it was found that there was no union of either fracture, the loss of substance on the left side being about 5 cm. and on the right, about 1 cm. Aug. 11, 1925, a graft from the crest of the left ilium was inserted in the defect on the left side. Sept. 22, 1925, an osteoperiosteal graft from the right tibia was inserted in the defect on the right side. The patient was discharged, Feb. 6, 1926, with complete consolidation of both sides.

CASE 7.—A. T., a private in the infantry, sustained a gunshot fracture of the right side of the mandible in action in France, in 1918. After infection had cleared up, it was found that he had a wedge-shaped defect in front of the second molar, its base being about 3 cm. long. A bone graft from the crest of the right ilium was inserted in the summer of 1919. There has been a good opportunity to follow this patient closely during the seven years that have elapsed since the operation was performed, and a radiogram, taken May 4, 1926, showed perfect consolidation. This and other long standing cases that have been observed refute the belief that these bone grafts undergo absorption after a time.

Of the seven cases of mandibular bone grafting reported, five had no relationship to war injuries; three were for defects following osteomyelitis of dental origin, and we have records of a fourth not reported in this series. Two of the cases involved defects of traumatic origin. In civil practice, I have had five cases of bone grafting of the mandible, two for defects of traumatic origin, two following resection of the bone for neoplasm, and one required for loss due to osteomyelitis.

From the cases recorded, it will be seen that either the osteoperiosteal graft from the tibia or the full-thickness graft from the crest of the ilium is preferred for restoring defects in the mandible. The osteoperiosteal method is chosen when the defect is small, not exceeding 1.5 cm., or where it is diffcult to obtain sufficient exposure of fragments for drilling holes through the bone for passage of wire sutures. The ilium graft is usually employed in defects over 1.5 cm., where the ends of the fragments can be readily exposed and where the bulky nature of the graft can be utilized to build out a depression visible externally.

The last case to be presented does not involve bone grafting.

CASE 8.—G. W., a discharged soldier, injured July 3, 1925, in an explosion of an automobile tire, sustained fractures of the nasal, palate and maxillary bones, and laceration of the soft tissues of the face. There

was a complete transverse fracture above the alveolar processes of the maxillae. The nasal bones were comminuted and displaced backward. The displacement of the maxillae resulted in an "open bite," the molar teeth occluding, but the other teeth failing to meet when the jaws were closed. The maxillary fracture was gradually reduced and fixed by means of the reversed Kingsley splint attached to the upper teeth, with bars protruding from the corners of the mouth and connected by straps to a plaster-of-Paris skull cap. The nasal deformity consisted in marked concavity of the bridge of the nose with upturned tip, so that the nostrils faced forward. This deformity was due to backward displacement of the nasal bones and destruction of some of the lining mucous membrane, with scar-tissue contraction. Correction of the deformity was undertaken by a two-stage operation, according to the method of Nélaton and Ombrédanne. March 9, 1926, under ether anesthesia, an inverted U-shaped flap of skin was raised over the dorsum of the nose, the top being at the nasion and the arms of the incision extending down the sides of the nose. As the dissection approached the tip, the nasal lining was cut through below the lower border of the nasal bones, this permitting the tip to be brought down into normal position, but creating a considerable opening into the nasal cavity. A vertical tongue-shaped flap of skin with its pedicle between the eyebrows was then raised from the middle of the forehead and turned downward, and its distal end was sutured into the gap in the nasal lining with skin facing into the nasal cavity. The interposition of this flap by supplying lining effectively kept the tip of the nose down in normal position and also raised the bridge. The forehead defect was obliterated by suturing its edges together. March 23, 1926, two weeks later, under local anesthesia, the pedicle of the forehead flap was severed and its edges were adjusted and sutured to the surrounding skin. It was unnecessary to use any costal cartilage or tissue other than the forehead flap to restore the prominence of the nasal bridge.

The object of this report is to show the justification for the continuance, in times of peace, in Army medical Centers, of the war-time organization for special treatment of maxillofacial cases.[2]

DISCUSSION

Fulton Risdon, Toronto, Canada: Few men in this country have had the unusual experience of handling these difficult cases in which considerable bone and soft tissue have been lost, and it is to be hoped that this knowledge obtained from military surgery will be dispensed as widely as possible, and, wherever possible, applied to civil cases. There is one question that I would like to ask Dr. Ivy, and that is why he uses the osteoperiosteal graft when a full-thickness free graft from the ilium will give greater bulk. I have not used the osteoperiosteal graft to any extent, and I cannot agree with Dr. Ivy that it should displace the full-thickness bone-free graft, which must give many more living bone cells to act as a scaffold for the regeneration and union of the grafted area. Dr. Ivy's method of using the osteoperiosteal graft is, I think, unique, and no doubt accounts for the excellent results he obtains. I was glad to hear him say that he allows from four to six months to intervene between the cessation of pus and the time of operation; and this, I believe, is one more reason for his uniformity in results. His soft tissue work is fine.

2. The writer is greatly indebted to Major Benjamin Norris, Medical Corps, to whose careful postoperative surgical attention the successful outcome of these cases is largely due; also to Captains B. M. Epes and C. W. Scogin, Dental Corps, who handled the equally important oral surgical aspects of the cases, fixation of fractures, etc. Captain F. M. Tench, Dental Corps, was responsible for construction of the splints. Special acknowledgment is also due to Captain B. M. Epes for gathering together the records of these cases.

THE RELATIONSHIP OF THE TEETH TO THE MAXILLARY SINUS: ANATOMIC FACTORS UNDERLYING THE DIAGNOSIS AND SURGERY OF THIS REGION*

By HUGH W. MacMILLAN, D.D.S., M.D., F.A.C.D., Cincinnati, Ohio

THE frequent troublesome postoperative complications following surgical procedures adjacent to the antrum accentuate the importance of the diagnosis and the surgical technic employed in the treatment of pathologic processes associated with the teeth in this region. Variations of the zygomatic process, and of the vault of the mouth; the difference in the degree of the angle formed by the interproximal planes with the sagittal plane, and the comparative inaccessibility of this region are among the chief difficulties encountered in the diagnosis. Exact knowledge of the normal dental anatomy and of the individual characteristics of the bone surrounding each root, including further knowledge which may be gained by special examination, is the basis on which a scientific surgical technic is founded.

The work recently done by Boyne[1] in his studies of the topography of the maxillary sinus is so comprehensive that the reader is referred to his published article for an exact description of what might be termed the normal variations of this region. The clinical application of Boyne's studies is that any or all of the variations which he has noted should be looked for in each individual case. Hence, it is the aim of the careful operator to use every means at his disposal to acquaint himself with all the individual variations, in order to forestall unpleasant end-results.

The chief agent in detecting individual variations is the roentgen ray. The maxillary molar technic has been so standardized by Charles G. Rowley of Northwestern University that he is able to depict on the film the periapical region of the maxillary molars, with the greatest ease, speed and accuracy. Mr. Rowley's technic for radiographing this region is as follows:

The patient should sit erect with the sagittal plane of the head perpendicular and the occlusal plane of the maxillary teeth parallel to the floor. The film is placed with the long axis in a horizontal position, and so that the anterior margin will come between the second bicuspid and first molar. The lower edge of the film should extend about one-eighth of an inch below the occlusal surface of the teeth, the teeth being parallel and vertical with the film. With the film in this position the operator places the patient's thumb in the median line of the vault, thereby holding the film in position by slight pressure along the upper edge. Pressure by the thumb should not be exerted towards the

*Read before the Section on Exodontia, Anesthesia and Roentgenology at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

1. Boyne, H. N.: A Study of Forty-Three Maxillary Sinuses, J.A.D.A., 13: 574 (May) 1926.

teeth, thereby bending the film, nor should the film be bent before insertion. The rays are carefully directed at right angles to the

Fig. 1.—Difference in the degrees of the angles formed by the interproximal planes with the plane of the film, showing the impossibility of examining without superimposition the posterior maxillary and mandibular interproximal spaces in a single negative.

line of bisection between the film and the teeth with the central portion of the rays directed underneath the malar process and centered at the second molar.

Careful attention to all the details as outlined in the Rowley technic will result in a negative showing the parts in their true relative positions.

Reflex pains of dental origin in the maxillary molar region are difficult to diagnose on account of the comparative inaccessibility of this region. The roentgen ray is of great assistance in the examination of fillings and inlays, and in the detection of primary or recurrent caries. One of the greatest contributions to dental science has recently been made by Howard R. Raper[2] in the examination of the heretofore almost inaccessible interproximal surfaces of the teeth. The Raper method is ideal when the interproximal planes are at right angles to the film. Where the interproximal planes are at an angle of from 60 to 70 degrees, the resulting negative shows a superimposition of the mesial and distal surfaces of the teeth which defeats the purpose of the examination. Figure 1 clearly shows the degree of the angle formed by the interproximal plane and the sagittal plane in the maxillary molar region. In order to parallel these planes, it is necessary to use a device with an indi-

2. Raper, H. R.: Clinical Preventive Dentistry, Rochester, N. Y., Ritter Dental Mfg. Co., Inc., 1926.

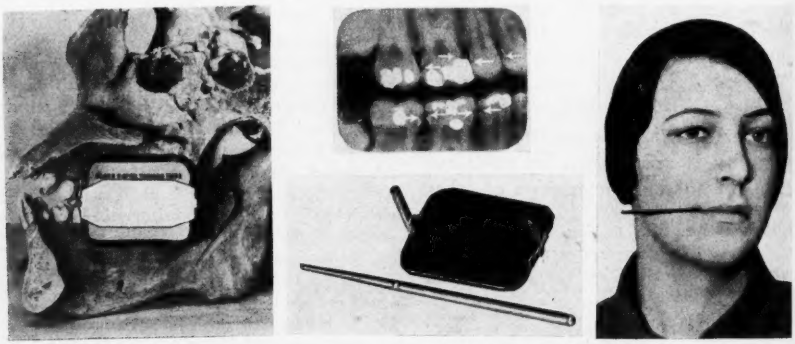

Fig. 2.—Interproximal technic employing the standard film and furnishing a means of examining the interproximal plane in question without superimposition by paralleling the tube with the indicator, which is adjusted to the angle desired.

cator which may be adjusted to parallel the interproximal plane in question.

Such a device is shown in Figure 2. The advantages of this holder, which may be constructed from 28-gage brass in a very few minutes, are as follows: 1. All standard size films can be used. 2. The size adapts itself to the mouth without discomfort. 3. After the corners are bent slightly, the center of the film presents a flat surface; which prevents distortion of the image. 4. The indicator enables the operator to parallel teeth, film and tube opening or to parallel any individual interproximal plane. 5. The device is especially useful in children's mouths. 6. Results can be duplicated. 7. The developed negative shows no part of the holder. 8. Last, and by no means least, the holder can be sterilized by boiling.

The holder is designed for the examination of the teeth posterior to the cuspids. The plan of examining the anterior maxillary and mandibular teeth on one film has not proved practical.

In placing the holder in the mouth, the following points should be observed:

1. Adjust the indicator to parallel the interproximal plane in question.
2. Place the holder in position in the mouth with the posterior guide just behind the third molar over the retromolar triangle.
3. Parallel the film with the mandibular bicuspids and molars, holding the film at least one-fourth inch from the lingual surfaces.
4. With the indicator resting between the mandibular cuspid and first bicuspid, instruct the patient to close the jaws slowly and carefully until the teeth grasp the holder firmly.
5. Do not attempt to pull the holder tightly against the lingual surfaces of the teeth.
6. Parallel the cone with the horizontal and vertical planes, using the indicator as a guide. Departures from normal occlusion must be taken into consideration.

This method has been found indispensable in searching for departures from the normal in the crowns of the teeth and along the alveolar border, particularly in the maxillary molar region. Its application to various other branches of dentistry is apparent. It is

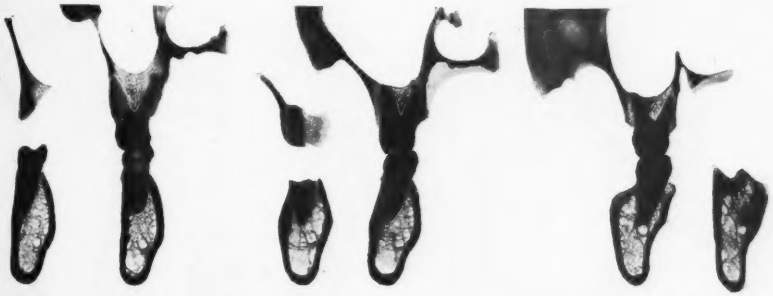

Fig. 3.—Arrangement of the alveolar process around the roots of the teeth, which is distinctively different in the first, second, and third molar regions.

the result of attempts to further standardize dental diagnosis by exact methods.

In a paper entitled "Maxillary Sinusitis: The Problem of Cooperation," Waldron[3] has most emphatically and accurately discussed the treatment of infections of the antrum following tooth extraction:

Lyons, from a detailed study of a hundred cases of empyema of the antrum of Highmore secondary to the extraction of teeth, concluded that in most instances penetration occurs, first, as a result of the rocking movement of extraction, which tears into the antrum at the point immediately above and in contact with the root, and, secondly, as a result of the failure to extract all the root, with subsequent displacement of the root tip into the antrum on attempting its removal.

Further quoting Waldron:

Fig. 4.—The "axis traction" method of tooth extraction illustrated in the maxillary first molar region. By hand pressure or mallet, the exolever is forced along the side of the root, therefy lifting up the gingival third of the alveolar process intact with its periosteum without damaging the gingival margin. The difference in the size of the arrows graphically shows the relative amount and the direction of the forces employed in applying traction in the line of least resistance and in buccolingual displacement.

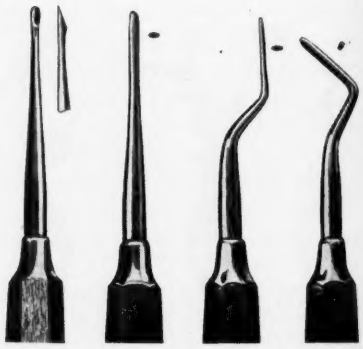

Fig. 5.—Special chisel and double convex tapering elevators for the recovery of fractured apices in the maxillary molar region.

We cannot ignore this situation nor dodge our responsibilities in the matter of the training of dentists to handle these conditions correctly. As long as root ends bear a close relation to the antral floor, accidental perforations will not be infrequent. More or less uniform and standardized methods of taking care of infected teeth should be taught in dental schools. The use of procain should be advocated in order to afford sufficient time for careful operative work under direct vision, with good illumination. The necessity of taking steps to reduce traumatism to the minimum, avoiding the fracture of alveolar process or root ends, should be emphasized. . . . Careful drying of the root sockets will permit accurate visualization of the periapical area, and thorough removal

3. Waldron, C. W.: Maxillary Sinusitis: The Problem of Cooperation, J.A.M.A., 85: 1531 (Nov. 14) 1925.

of infected tissue by curettage is made possible. All unnecessary removal of alveolar process beneath the floor of the sinus should be avoided. Forcible irrigation of the sockets should not be done. Gentle irrigation or mopping should be the rule. The dentist carrying out such technic sees what he is doing and is master of the situation when root tips are broken off or the sinus floor is penetrated. He can recover the fractured root end, remove the affected tissue, and assure the closure of the perforation by adjusting the gingival margins and suturing. An edge to edge closure is not necessary nor desirable. The operator must recognize the importance of keeping such cases under observation . . . .

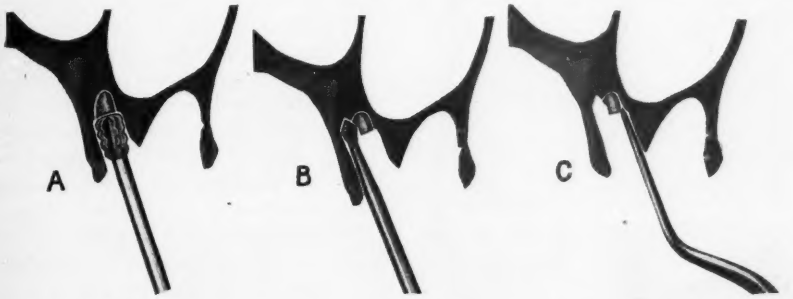

Fig. 6.—Standardized technic for removal of the fractured apical third of the lingual root of the maxillary first molar.

The reference of Lyons to the rocking movement of extraction invites a discussion of what is the most scientific method of extracting the maxillary molar teeth. A study of the diagram that shows the prevailing anatomic structure of each molar tooth and the characteristic arrangement of the surrounding bone discloses to the most casual observer that the extracting force should be applied to each molar in a decidedly different manner. Boyd S. Gardner has stated that most perforations of the antral floor which he has observed have been made in the attempt to extract the fractured apex of the lingual root of the first molar. The "rocking movement" is responsible for the fracture and, indirectly, for the consequent perforation.

Before outlining the "axis traction" method of extracting the first molar, it is necessary to evaluate properly the significance of the difference in thickness of the bone buccal to the roots of the molars and the individual characteristics of the molar roots. In Figure 3 is seen the thin parchment-like bone covering the buccal roots of the first molar, the thicker bone covering the second molar, and the thickest bone buccal to the third molar. It is recalled in Black's[4] descriptions of the roots of maxillary molar teeth: "The roots of the first molar are widely separated . . . the roots of the second molar . . . spread less . . . and the roots of the upper third molar . . . are not so widely separated as those of the first and second molars . . . ."

The following method, illustrated in Figure 4, is offered as a standardized

4. Black, G. V.: Descriptive Anatomy of the Human Teeth, Philadelphia, S. S. White Dental Mfg. Co., 1902.

technic for the extraction of the maxillary first molar: In accordance with the interalveolar plate technic elsewhere described,[5] the bone buccal to the molar

Fig. 7.—Standardized technic for removal of the fractured apical third of the mesiobuccal root of the maxillary first molar.

is carefully separated from the roots, leaving it intact with the mucoperiosteum. The forceps are adjusted, and carefully controlled traction is applied in the line of the long axis of the lingual root, the buccolingual pressure used in dislodging the tooth being so slight as to be hardly noticeable. This method avoids tearing out the buccal plate, minimizes traumatism, avoids fracture of the roots and leaves the fragments of bone separated from the tooth by the chisel to act as osteogenic islands which rebuild the alveolus in conformance to the new static conditions presented.

In the extraction of the second and third molars, the basis of the technic is the same. The direction of the traction will be changed to conform with the axes of the roots and the resistance made by the bone. Axis traction must also take into consideration that these roots "are curved more to the distal."

The removal of fractured roots in the region of the floor of the maxillary sinus requires the most careful and exacting technic. Here again, an intimate knowledge of the anatomy peculiar to the region under consideration is indispensable. Instruments must be selected which will enable the operator to work with the greatest delicacy and accuracy. As a corollary, it might be emphasized that forceps have no place in the removal of a fractured root apex in this region.

The instruments particularly designed for this work are three in number and of two types: first, a delicate chisel for separating thin alveolar plates from the roots, and, second, two straight, double convex, tapering elevators to be used in conjunction with special bone drills in dislodging the root (Fig. 5, Nos. 7, 8, 9). The chisel is to be used only for cutting thin bone. The special elevators are designed on the principle of the

5. MacMillan, H. W.: The Clinical Application of Some Anatomical Facts to . ·ntal and Oral Surgery, Bull. Chicago Dent. Soc., 5: 10 (April 10) 1925.

double inclined plane with the effort applied parallel to the base. The effort may be applied by hand pressure or mallet.

In order to remove the fractured apical third of the lingual root of the maxillary first molar with the greatest conservation of the alveolar process, a special bud-shaped drill of the same diameter as the entrance of the lingual alveolus is used to enlarge that part of the alveolus between the entrance and

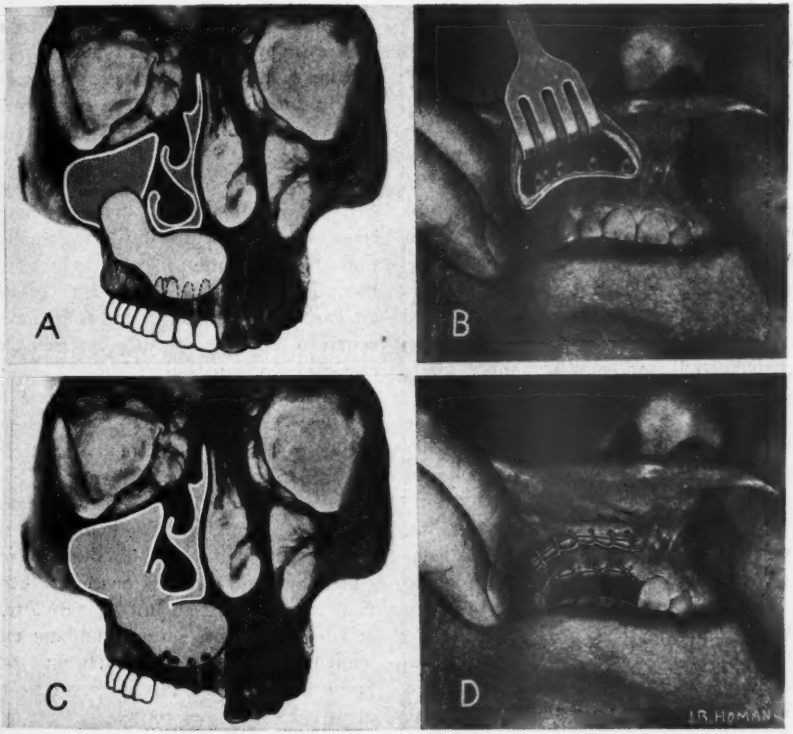

Fig. 8.—*A*, diagrammatic view of an extensive maxillary cyst elevating the floor of the nose and invading the maxillary sinus. *B*, opening made through the anterior wall of the cyst. The root ends are amputated in order to secure better access and to preserve the alveolar ridge; cyst membrane enucleated, opening between cyst and sinus enlarged, and nasal wall beneath inferior turbinate removed through this opening. *C*, diagrammatic view, showing the conversion of the cyst into a recess of the antrum, the opening for nasal drainage, and the retention of the healthy mucoperiosteum over the unaffected part of the sinus. *D*, appearance of mouth just before closure. The amputated teeth are extracted and the gingival portion of the labial plate is crushed in, in order to hasten osteogenesis, and the openings of the alveoli are closed by sutures. The original incision is then hermetically closed and future treatment is by the nasal route.

the fragment. A small Henahan drill is then used to remove that part of the bone adjacent to the mesial, lingual and distal surfaces of the root. Into the space created by the drill, the root fragment is directed by the application of the special elevators Nos. 8 or 9, in the joint between the root and the bone adjacent to its buccal surface. A study of Figure 6 clearly illustrates the technic as outlined.

The technic (Fig. 7) for the removal of the buccal roots of the molars depends on the thickness of the buccal plate. In the first molar, the thin buccal plate is separated from the tooth by the chisel. The chisel is so constructed that the edge of the blade is on a straight line with the shaft, thereby enabling the operator to engage the pericemental junction by simply guiding the chisel along the wall of the alveolus. After the separation of the buccal wall with the chisel, the No. 8. elevator quickly dislodges the root in a direction away from the antral cavity. In the second and third molar regions, where the bone is much heavier, a technic similar to that used for removing the lingual root of the first molar is used.

Radicular cysts of the teeth often grow to such size that the cancellous bone between the maxillary buccal and lingual plates is destroyed, the alveolar plates are thinned by pressure atrophy, the floor of the nose may be pushed up and the maxillary sinus invaded. Many operators, in correcting these enormous cysts, remove teeth, alveolar ridge and mucoperiosteum, leaving an enormous cavity in the upper jaw which, at times, may communicate with the nasal fossae and maxillary sinus. The application of the anatomic fact that the maxillary sinus may extend to the median line is the basis of the technic, which consists in converting these enormous cysts into an extension of the maxillary sinus and, at the same time, securing an alveolar ridge comparable to that which would have obtained had the teeth been lost by one of the usual processes.

Under block anesthesia of the nerves supplying the maxilla, including Meckel's ganglion, an opening is made in the anterior wall of the cyst somewhat similar to the opening made for the Caldwell-Luc operation (Fig. 8). The root apices projecting into the cyst cavity are amputated, the remaining roots being left *in situ* until the completion of the operation in order to preserve the alveolar ridge with the greatest care. The entire cyst membrane is removed, and the aperture between the cyst cavity and maxillary sinus is amply enlarged. Semipermanent drainage is created through an opening in the inferior meatus. The amputated teeth are then extracted with great care. The gingival portion of the buccal plates are crushed into the alveoli in order to hasten osteogenesis and the alveoli closed by suturing, this procedure hermetically sealing them. Finally, the original incision is sutured, and the extended sinus thus completely cut off from the mouth. Postoperative treatment is by the nasal route.

Several years ago while browsing through the shelves of a second-hand medical book store, I found the following quotation in an old copy book written with a quill pen: "The knowledge of Anatomy, while it renders a bold operator less fearful, gives boldness to him who is naturally timid, and enables him to perform operations which he has never seen, or perhaps have never been performed."

THE MOST SENSITIVE AREAS OF THE TEETH AND THEIR OPERATIVE TREATMENT*

By CHARLES F. BODECKER, D.D.S., F.A.C.D., New York City

THOROUGH confidence of the patient in the operator is an important matter in successful practice and one which young operators frequently find difficult to achieve. This confidence is based on two diverse factors, one, the belief in the operator's technical skill, the other, the feeling that the operator is intensely concentrated on the work in hand and does not cause any more pain than is absolutely necessary. Nothing will increase this conviction in the patient more than the ability of the operator to prophesy the painlessness or painfulness of the various steps in the preparation of a cavity.

Many patients, and this is particularly true of the nervous ones, expect to experience pain from start to finish. If the operator knows the sensitive areas of the teeth, he may calm the patient's fear at certain times, cause him to relax and thus remove the nervous strain of a greater part of the process of excavating cavities. In order, therefore, to call attention to these areas of excessive sensitiveness, this paper is presented.

GENERAL CAUSE OF SENSITIVENESS

The manner in which sensation is transmitted through the dentin to the pulp is not clearly proved. The presence of nerves in this tissue, as claimed by Mummery, Morgenstern, Dependorf and Roemer, has now been absolutely proved by Tojoda.

Increase of Sensitiveness by Acid Reaction.—Observant clinicians will have noted the fact that newly carious areas are more sensitive than those that have already been filled. The probable cause of this is that dental caries is accompanied by the formation of lactic acid, and it is this acid which greatly increases the irritability of the protoplasmic contents of the dentinal tubules. In order, therefore, to reduce the pain experienced by the patient in the excavation of newly carious areas, it is necessary first to neutralize the acid always present in such cavities. This cannot be done in a moment by swabbing out with a solution of sodium bicarbonate. A dressing of some slightly alkaline antiseptic and sedative medicament must also be sealed into the cavity and allowed to remain at least forty-eight hours. The procedure that I usually adopt is to wash out with a weak surgical solution of chlorinated soda and sodium bicarbonate and seal with temporary stopping dipped in validol camphorata. This seems to have a remarkable sedative effect in the irritable condition of the dentinal fibrils, besides being a solvent of guttapercha and thus

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

sealing the cavity thoroughly from external influences.

THE MOST SENSITIVE AREAS

There are four areas in each tooth (Fig. 1) which are exceedingly sensitive: (a) the pulp; (b) the dento-enamel junction; (c) the granular layer of Tomes; (d) the interglobular spaces.

Pulp.—The pulp need not be considered, for its location as well as its extreme sensitiveness is commonly known. The layman, for this reason, calls it

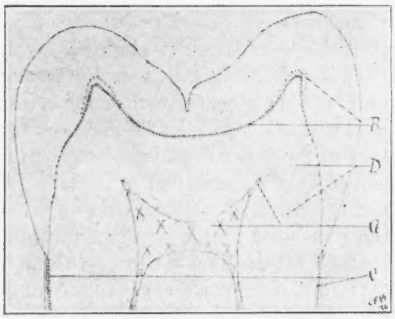

Fig. 1

the "nerve" of the tooth. This designation is incorrect, as it consists of numerous other elements besides nerves.

Dento-Enamel Junction. — The cause of the increased sensitiveness of the area at the dento-enamel junction to the excavating instruments is its greater abundance of organic matter. (Fig. 2.) This increase of noncalcified or organic matter results from forking of the dentinal tubules in the dentin, and from the enamel spindles and tufts in the enamel.

Dentinal Tubules.—Figure 2 shows the branching of the ends of the dentinal tubules as they approach the dento-enamel junction. This diagram clearly shows that our instrument comes into simultaneous contact with a great many more tubules in excavating this area than deeper in the dentin, thus explaining the increased sensitiveness of this area.

Enamel Spindles.—A certain percentage of dentinal tubules pass across the border into the enamel and end in variously shaped spaces filled with noncalcified, protoplasmic material. Many have the form of slender spindles and they have therefore been named enamel spindles (Fig. 2).

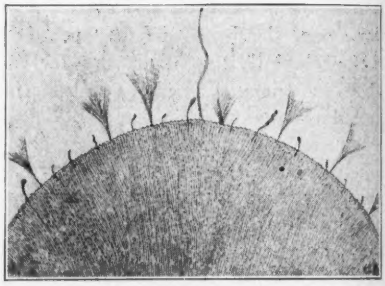

Fig. 2

Enamel Tufts.— These tufts, which I discovered and named,[1] are spiral-like structures, arising from a narrow base at the surface of the dentin and passing into the enamel for from 0.5 to 3 mm. (Fig. 2.) They appear like tufts of beach grass in profile. The tufts are also composed of noncalcified matter and therefore comprise an area of increased sensitiveness during the excavation of cavities.

The proof that the three above described structures are in close connection with the dental pulp is shown by the possibility of staining these through injec-

1. Bödecker, C. F.: Dent. Rev., 19: 448 (May 15) 1905, 20: 317 (April) 1906.

tion of stains from the pulp chamber. The mechanical irritation of excavating tissues at the dento-enamel junction is therefore transmitted directly to the nerves of the pulp, a painful sensation resulting.

Granular Layer of Tomes.—The distribution of the granular layer of Tomes, contrary to the teachings of some textbooks, is restricted entirely to the root dentin. This noncalcified, and therefore highly sensitive, zone is found on the periphery of the root, where it is covered by the cementum. (Figs. 1 and 3.) The "sensitive necks" of teeth owe their intense sensitiveness to the exposure of the granular layer of Tomes. This structure is normally covered at the cervix of the tooth by a thin layer of cementum, which is, in turn, shielded by the gingiva (Fig. 3). The recession of the gingiva or gum tissue exposes the cementum, which is soon worn away by erosion or the incorrect use of the toothbrush, thus exposing the sensitive granular layer of Tomes (Fig. 4).

Further investigation will possibly show the presence of nerve end-organs in the granular layer of Tomes, as well as in some of the endings of the dentinal tubules. Should this prove to be true, it would explain the clinically observed fact that superficial gingival cavities involving the granular layer of Tomes are more sensitive than deeper cavities in this area, in which the entire granular layer has been destroyed. Such end-organs in the granular layer would naturally be more highly sensitive than the nerve filaments leading to them through the dentinal tubules.

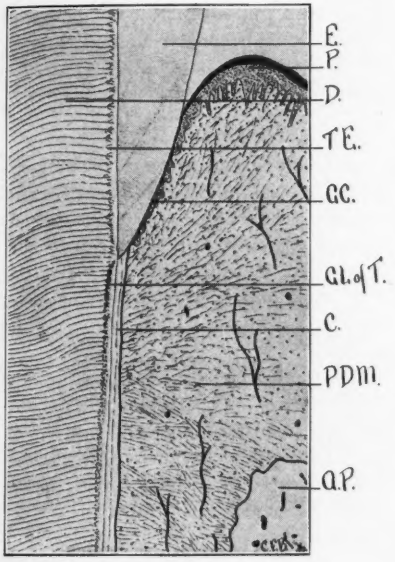

Fig. 3

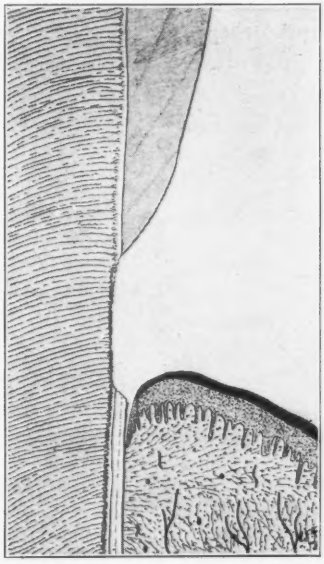

Fig. 4

A practical result of the observation that it is principally the granular layer of Tomes that is responsible for the sensitiveness of "sensitive necks" is the feasibility of cauterizing such areas with zinc chlorid or, in the case of the upper third molar, with silver nitrate, thus relieving the patient. If the operator is successful in destroying the noncalcified material in the granular layer, the sensation will be greatly reduced to external irritants such as cold or sourness.

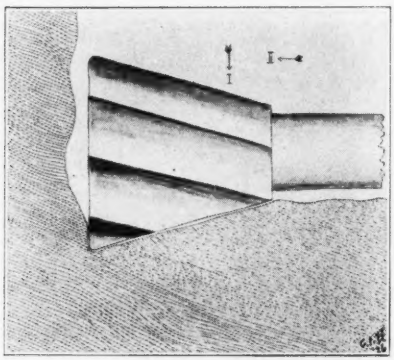

Fig. 5

Interglobular Spaces.—The presence of interglobular spaces in the dentin is a sign of poor calcification of the tooth, making its structure comparatively soft and more sensitive to our instruments. Clinicians know that so-called soft or malacotic teeth, due, in part at least, to the presence of the interglobular spaces, are always more sensitive than the hard or sclerotic types. The reason that the interglobular spaces are more sensitive than the surrounding normally calcified tissue is again the presence of noncalcified material.

It is more difficult to specify the exact distribution of the intergobular spaces. They are most commonly found in the area shown in Figure 1 *D*, in a single or double row, running somewhat parallel to the dento-enamel junction. The entire dentin of such teeth is usually sensitive so that all tissue still in direct connection with the pulp will react painfully to our instruments. If this connection is cut, the operator can remove this dentin painlessly, as described under Figure 5. The poorer the calcification of the tooth, the larger the area of distribution of the interglobular spaces.

OPENING OF CAVITIES

It is not my intention to give a complete description of the operative procedure of preparing cavities; neither is any orginality of method claimed. I wish to mention some of the operative steps and specify which of these should cause the least pain to the patient.

As mentioned in the introduction, the confidence of the patient in the individual operator is an important matter. If the patient feels that the operator knows exactly where the sensitive areas are and notes a mental concentration on the work in hand, the patient will endure more pain, for he is convinced that all he endures is necessary. But when he imagines that the operator is drilling at the tooth as if it were a piece of wood, and is showing little concentration, the patient will register sensation much sooner. He may have confidence in the operator's skill, but will have the feeling that he may possibly be enduring unnecessary pain.

A knowledge, therefore, of the above mentioned particularly painful areas, will assist the operator in, at first, avoiding them by taking away those parts of the cavity walls which can cause

no sensation. The patient, who has steeled himself to stand the worst, will consequently heave a sigh of relief and relax.

It seems hardly necessary to mention that the chisel is an instrument causing the least amount of pain, working at the same time rapidly and correctly. Care should be taken not to let the edge plunge deeply into the cavity, and thus possibly come into contact with the sensitive dentin.

Let us go through some of the stages of preparing a cavity in an occlusal surface of a molar and tell the patient at which time the operation will be *painless*, when pain may possibly result, and when it is certain to appear.

After the nonsensitive, overhanging walls have been removed with a chisel, the pits and grooves are ground out with burs, or if large, with small stones. This will accustom the patient to the noise of grinding and fulfil the prophecy of the operator that it will cause no pain. Now the interior of the cavity may be attacked with spoon excavators, the patient being warned that he may experience a slight sensation. The sensitive and nonsensitive areas are noted as the leathery, decalcified dentin is lifted off. Next, a large bur is used, the operator notifying the patient of the chances of pain according to the observations made by the aid of the excavator. If intense pain is felt, a local application of an obtundant will be of service, as the sensitive areas are now exposed by the removal of the nonsensitive parts, this allowing the medicament to act more freely. A procain pressure anesthesia pellet will often be of service. Cocain phenate as introduced by C. F. W. Bödecker gives excellent results.

USE OF THE BUR

The manner in which a bur is used to excavate dentin is important. The operator should always visualize the direction of the dentinal tubules in relation to the cavity walls. Figure 5 shows a small inverted cone bur and its correct and incorrect use. If pressure is brought to bear on the bur parallel to its axis (shown by the arrow II in the illustration) the bur will follow up the dentinal tubules and slowly approach the pulp. The entire duration of such drilling will be painful, for the bur will be lacerating dentinal tubules that are in direct connection with the pulp. In addition, there is another factor which causes unnecessary pain. A bur (and this applies similarly to a round bur) has the least cutting power at its apex; the pressure of this part against the dentin causes undue friction which, in turn, generates heat, and it is this heat that results in needless pain.

The correct method, of course, involves the use of lateral pressure, (Fig. 5 *I*) allowing the cutting leaves of the bur to remove the dentin. This should be started at the very depth of the cavity, the patient being warned of impending sensation. Figure 5 indicates why the depth of the cavity is selected for the first action of the bur. When the connections of the dentinal tubules are cut in the depths, the more external areas, having lost contact with the pulp, can be removed painlessly.

DISCUSSION

Leroy L. Hartman, New York City: One point rightly stressed is that we are dealing with vital tissues and that we should respect and treat those tissues to the best of our ability. We are all familiar with the pulp

and dento-enamel junction as factors in communicating pain to the patient, but the description of the "granular layer of Tomes" helps to explain some of our problems in dealing with sensitive exposed roots. The description of the "interglobular spaces" gives a good explanation of very sensitive teeth which usually call for an anesthetic before a good cavity preparation can be completed. As for Dr. Bödecker's procedure in cavity preparation, I believe that he should have stressed particularly the importance of working in a dry field, using sharp burs and sharp cutting instruments. The advantages of employing inverted cone burs over round and fissure burs are clearly presented, but I cannot agree in the use of a large bur in any step of cavity preparation in vital tooth structure. I further do not believe that it is necessary to neutralize the acid in newly carious areas or to seal obtundants into cavities to reduce sensitiveness. A knowledge of the details of the structures involved, the use of the smaller sizes of inverted cone burs, with the systematic use of cutting instruments, will certainly inspire the patient with confidence in the operator, and will mean rapid and painless completion of the operation in hand.

THE MINIMUM BASIC TRAINING FOR THE PRACTICE OF MEDICAL SPECIALTIES, INCLUDING DENTISTRY*

By GUY S. MILLBERRY, D.D.S., San Francisco, California

THE title of this paper, when submitted to me, suggested a brief comparative review of the present tendencies in dental education. Any paper on this subject must of necessity take cognizance of these tendencies, and since we are still in the curricular epoch, though rapidly approaching a more liberal educational policy, it may be well to discuss the subject in terms of existing procedure.

It is a simple thing to set up a standard curriculum on paper in any field of educational endeavor. It is not very difficult to induce an educational institution to adopt it. The real task is to determine whether such a curriculum will be productive of the results desired and whether it is educationally and economically sound or not.

If education is intended to create a strong race, and if the business of education is the most important, if not the largest, business in America, and I believe that it is both the most important and the largest, a careful analysis should be made year by year to determine whether or not our systems of education and our educational institutions are accomplishing the things that this nation expects of them.

My thesis demands a brief analysis before a premise can be established, because there is an essential difference between dentistry and other medical specialties, such as rhinology or ophthalmology, that difference being the technical procedures in the handling of inert matter that the dentist is expected to perform.

If the reparative and restorative procedures in dentistry are excluded from the discussion, the problem is simple; but the largest part of dental practice today includes these procedures, and dental schools must continue to supply

*Read before the Section on Dental Education at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

this instruction until there is no longer a need for it.

If we accept oral surgery, extraction, orthodontics, mouth hygiene, periodontia, prophylaxis, root canal therapy and first aid treatment as the practice of dentistry, we may accept dentistry as a specialty in medicine in the full sense of that term; for these branches are comparable with operative and therapeutic practice in other fields of medicine, particularly those involving the head, and the basic training for such practices should be similar. Incidentally, diagnosis and prognosis under such conditions should require equal training; which further strengthens our premise.

Most educators agree that a knowledge of certain subjects is essential to the practice of medical science. One need but review the announcements of all schools engaged in this endeavor to find zoology, chemistry and physics dominating the preprofessional curriculums, with modern language as next in order, and anatomy, physiology and pathology as the basic medical sciences.

If these subjects are essential, the next step is to determine how much knowledge of each of them is necessary for the practice of a specialty in medicine, for each of these sciences offers the opportunity for a life study in any one of their several branches.

Granting that zoology, chemistry and physics are desirable prerequisites for a doctorate in medicine or dentistry, a liberal knowledge of the fundamental principles of these sciences is desirable.

Most universities offer year courses in these sciences of from six to ten units or semester hours as a standard. Some of them advise against taking more than one science in a given semester and many prohibit taking two by curricular arrangement, so that any program that demands these three basic sciences in one academic year is asking more than the average student can accomplish or the universities will allow. These three science courses, if given in one year, are absolutely inadequate from the university point of view.

RESULTS OF QUESTIONNAIRE

Subject	First choice	Second choice	Third choice	Total
Chemistry	45	11	2	58
Zoology	26	12	6	44
Physics	15	18	8	41

The premedical curriculum has been in vogue for a little over two decades. The practical value of it might reasonably be determined by inquiry among those who completed this curriculum when the courses were well established and yet sufficiently long ago for them to have had some experience in general practice.

The period 1916-1920 was selected as an appropriate time, and the graduates of the medical schools of Stanford University and the University of California were chosen as a suitable and accessible group. They are engaged in

all types of professional endeavor in all parts of this country.

To these men, three questions were addressed, as follows:

1. Which basic science or sciences, zoology, chemistry or physics, have you found to be most valuable in your professional work?

2. Has the foreign language requirement, a reading knowledge of French or German, been a distinct advantage or of practical value to you?

3. Of all other academic subjects taken in your premedical course, which do you consider of the greatest value?

Seventy-five replies were received, which is an average proportional response to a questionnaire. The results are shown in the accompanying table.

The distinct practical value of the application of these sciences to the practice of medicine is shown here, for modern physics is assuming a position of being fundamental to all science; and yet it is rated third by this group. Many of the answers indicated that all three were valuable and of such related importance that a decision was difficult to make.

The inquiry about the foreign language requirement brought forth approximately an equal number of positive and negative answers. Thirty-seven stated they valued this knowledge and thirty-eight said that it meant practically nothing to them. Those who favored its requirement were engaged in research or travel, or lived in communities where a foreign language could be used. Those who were on the negative side contended that they did not acquire a reading knowledge of the language during college residence or that the translations in the journals were better than they could make; hence, the time given to it in college was wasted.

The third question elicited rather interesting information. More than a third of the replies indicated that the English language was the most important subject other than the ones referred to. Twenty-six different subjects were mentioned as being of first importance, nine of them being in the biologic field. Music and dramatic art were given first place by some writers.

These data may be considered as but a collection of opinions. However, they have as much value as a clinician's opinion on a case, the element of experience being the major factor of value.

The practitioner who has forgotten the fundamental laws of physics or who cannot write a series of chemical reactions properly has, nevertheless, retained a certain understanding of these sciences without which his services would be a menace to society. One has only to hear reports given by or about individuals who lack such training to be cognizant of its value.

If these three sciences are necessary to fit one to practice a specialty in medicine or dentistry, as I believe they are, two years of academic study, during which time one year of inorganic chemistry, one semester of physics, one semester of zoology and one semester of organic chemistry are given, is necessary to obtain this preparation.

The second phase of the discussion raises another pertinent question: "Shall every student who expects to engage in a specialty in medicine, including dentistry, be required to pursue the same course of study in his professional curriculum?"

Is a knowledge of physiology more important than a knowledge of histo-

pathology in the practice of obstetrics? Is a knowledge of physiologic optics more valuable to the oculist than to the dermatologist? Is not biochemistry of greater value to the pediatrician and electricity to the radiologist than the reverse? Is a knowledge of the physical forces governing mastication of greater value to the oral surgeon or orthodontist that a knowledge of the biolgic forces governing tooth formation and eruption and bone growth? These and many other questions are before the educators and the public today. A satisfactory solution must be found.

I am not in sympathy with a standard curriculum for the practice of medicine or dentistry or any of their specialties. If a standard curriculum is to be set up, and it never will be, all practitioners of a given type must be trained in exactly the same way, taking the same courses of study for the same length of time, and, individual mentality permitting, they will all be possessed of about the same degree of knowledge and professional skill. Having been poured into the same mold, they will have become standardized. Their future success will depend on their personality and application.

Each group engaged in any phase of medical practice should pass courses in anatomy, physiology and pathology in keeping with their vocational or professional requirements. For unrestricted general practice, an irreducible minimum amount of instruction should be required, as it now is; but, for the specialties, unrestricted opportunity should prevail for the student who desires it. The scope and character of this instruction will not be determined today, but will be determined and modified each year as we develop normally in our educational endeavor.

Education is not a static but a dynamic force, ever changing to meet the requirements of our civilization.

Our institutions should offer not one course in anatomy or physiology for dental students, but a number of them, each graded to meet the needs of a particular class of students and, wherever possible without economic loss, arranged so that the completion of one course would lead to more advanced instruction in others of a similar or related type.

Teachers will find a free opportunity for the expression of their own development through teaching small groups in both preliminary and advanced courses which is not to be found in large classes. Mass teaching is not productive of the best results even though it must be followed where but one course of study is offered.

Peculiarly, the preprofessional curriculums are advocated for their cultural value, in part. The medical sciences are not ordinarily included in the list of cultural subjects, yet there is no reason why they should not be open to students in other departments of a university for cultural reasons alone.

Pathology may be a sordid and inappropriate subject for social gatherings, yet it is discussed daily at bridge teas and dinner parties. If it were intelligently discussed, the race would be better off.

Applied science and the ancillary subjects constitute the capricious elements in a curriculum. As long as institutions and men exist, there will be a division of opinion as to their necessity or value. Some teachers claim that dental pathology is only a part of general pathology and therefore should not

be taught separately; yet general pathologists hesitate to pass judgment on dental lesions because they are not familiar with them. Undoubtedly, the same basic pathologic conditions prevail in the mouth as elsewhere; yet the tissues are different or the area is unknown to the general pathologist, and it becomes necessary to train men in special fields of pathology to obtain the best results.

If otologic lesions demand special study on the part of the otologist before he is prepared to treat them or to operate, why should not our schools provide the opportunity for advanced study for such men? It does not follow that every medical or dental student, undergraduate, or graduate should take such instruction.

Orthodontics and oral surgery are the outstanding specialties in dentistry today, and they compare favorably with other specialties in medicine. Individuals who expect to engage in such fields of professional endeavor should be trained as medical students are, but not wholly in the same subjects. They must have training in the fundamentals of dental science, but it is not necessary to train them in all phases of restorative dentistry that general dental practice requires.

One other aspect of this problem demands brief consideration. Different levels of professional service in dentistry have been established and their number is being augmented periodically. These include technical dentistry and preventive dentistry, the latter being the most important.

For economic reasons, a specific curriculum will be required for the lower levels because of the limitation of the service and the time necessary to prepare for it. Reparative and restorative dentistry will be included in this plan.

This is the real issue in dental education today. It is impossible to train men adequately in technical dentistry if the amount of technical and clinical training is curtailed, and it is unnecessary to train men so thoroughly in the previously mentioned fields of dentistry that are related to medicine if they are to practice the technical branches of dental service.

If dental schools do not prepare to meet the problem, other institutions will. Adequate training to perform technical dental service can be provided in four years as is done in the routine procedures in other professions. Medicine has recognized this problem and is meeting it in many ways, including nursing service and pathologic and radiographic laboratory service.

Specialties in medicine or dentistry are only what the practitioners consider them to be. Laws do not make specialists, although they permit men to become such regardless of their training or experience. Occupational restriction is a widely discussed social and economic problem. Those occupations that deal with individual or community health are fortunately governed by some form of licensure or regulatory control.

For the benefit of the public, medical specialties will soon become subordinated to similar restrictions, and men will have to prove their qualifications to practice oral surgery before being permitted to practice this specialty.

Herbert Spencer said "The only rational mode of judging any educational course is to judge in what degree it discharges its function." If the primary aim of an institution of learning is to provide such instruction as shall meet the needs of the public, it would seem

that what the public needs in the nature of health service should be the guiding influence in shaping the destiny of medical and dental education. It seems to have been overlooked in this controversy.

If the tendencies point to a greater degree of specialization in medical science, our schools must adequately prepare for this by offering graduate or postgraduate instruction, and our laws must be amended to regulate the conditions pertaining thereto.

I am quite certain that no institution of learning can train students to meet the full requirements of the specialist during the undergraduate period; such advanced tutelage should come from the experienced specialist himself. I am equally certain that it is a wasteful procedure to train all men for general practice if interest, ambition and genius in a few individuals are to be thwarted because of frozen ideas in education.

Education has not yet passed the experimental stage, though some writers so state. All the facts as to what method in educational endeavor will bring the greatest happiness and comfort to our people as far as health service is concerned are not known, and therefore any method that has apparent value should be encouraged and not condemned. Time will determine whether it is founded on a true or a false hypothesis.

It requires good judgment, courage and a steady hand to steer any ship of education to its port. Some are of light draft, navigating provincial waters, and, with locally trained pilots, have little difficulty in avoiding dangerous channels. Others are parts of a fleet whose ports of call touch every phase of human endeavor and make contact with every range of human experience from the utmost degradation to the greatest happiness. Each must maneuver with the fleet in order to accomplish what the fleet has set out to do.

Confronted with the storms of teaching incompatibility, the shoals of professional interference and the reefs of financial difficulty, it is remarkable how successfully some have arrived at the present stage of their journey. Medicine and dentistry have achieved signal distinction in this respect.

Medical education is adjusting itself, after two decades of experimental effort, to approximately seven years of training, including two years of academic work, four years of professional work and one year of internship. It is also making provision for dependable assistance of various grades of subordinate character.

Dental education should profit by this experience and shape its destiny in the light of public need rather than of professional ambition.

May we not hope that the future will record an harmonious blending of all the professional phases of the art and science of medicine and an adequate and dependable provision for supplementary health service, both of which are so necessary to the happiness of mankind?

STUDIES ON VITAMIN DEFICIENCY DISEASES*

By TADASHI MASAKI, D.D.S., Tokyo, Japan

THE present study was commenced in April, 1923, and the results obtained up to the present time are briefly reported on this occasion.

The studies to be presented today consist of the following three parts:

I. Changes in the teeth and their investing tissues due to vitamin C deficiency.

This experiment was carried out with guinea-pigs. I first investigated the normal morphology and structure of the teeth of this animal, and then proceeded to study the pathologic changes in fifty-one guinea-pigs fed on a vitamin C free diet (oats, 53 per cent; casein, 25 per cent; butter fat, 10 per cent; Nelson and Lamb's salt mixture, 5 per cent; dried yeast, 2 per cent, and cane sugar, 5 per cent; or oats, 59 per cent; casein, 25 per cent; butter fat, 7 per cent; cod-liver oil, 3 per cent, and dried yeast, 2 per cent). Guinea-pigs kept under starvation were examined as controls. The following conclusions were drawn from this experiment:

1. The teeth of guinea-pigs are suitable for the study of developmental disturbance of the teeth.

2. In this animal, not only the crown of the molars, but also parts of the enamel of incisors, are covered by the coronal cementum.

3. A vitamin C free, but otherwise physiologically adequate, diet induces in guinea-pigs the condition of experimental scurvy.

4. The changes in the teeth due to vitamin C deficiency consist of imperfect development of enamel, dentin and cementum, and the change in the enamel can be demonstrated microscopically in about one week after the commencement of the experiment.

5. Changes in the softer dental tissues, especially the pulp and pericementum are characterized chiefly by hemorrhagic inflammation, accompanying various types of circulatory disturbances and retrogressive changes.

6. The formation of osteodentin which occurs as a result of the temporary hyperfunction cannot be considered as peculiar to a deficiency of vitamin C.

7. The appearance of calcific striations in the dentin is a result of vitamin C deficiency. It has a definite relation to the relative severity of the deficiency, becoming obscure when vitamin C is supplied.

8. Gum bleeding does not always occur, being found only in rare instances.

9. Histologic study of the dental decay in vitamin C deficiency indicates that the decay is not due directly to the deficiency, but the latter is to be looked on as a predisposing cause.

10. The changes in the dental tis-

*Read before the Section on Bacteriology, Pathology and Diagnosis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

sues in vitamin C deficiency are, therefore, scorbutic in character.

11. Under experimental starvation, the hard dental tissues undergo no marked change, and they show only a slight developmental arrest. The soft dental tissues show some circulatory disturbances and retrogressive changes.

The foregoing investigation reveals many defects in the composition and preparation of diets used by previous workers, in vitamin C deficiency, and I have been able to examine critically the previous work and to establish a new classification of scorbutic diseases due to vitamin C deficiency.

II. Changes in the teeth and their investing tissues due to vitamin A deficiency.

In this investigation, pathologic changes in thirty-two albino rats fed on a vitamin A deficient diet (rice, 72 per cent; casein, 12 per cent; olive oil, 10 per cent; Nelson and Lamb's salt mixture, 4 per cent; dried yeast, 2 per cent; or dextrin, 66; casein, 18 per cent; olive oil, 10 per cent; Nelson and Lamb's salt mixture, 4 per cent, and dried yeast, 2 per cent) were minutely examined, and were compared with the normal dental conditions in this species of animals. The results may be summarized as follows:

1. Young albino rats fed on vitamin A free diet invariably show eye disease in from twenty to forty-nine days.

2. The reports of other investigators do not exactly agree with the foregoing observation, but the discrepancy is explainable partly on the basis of individual variations of animals, and more especially on the improper purification of the casein used in the preparation of the artificial food.

3. Albino rats manifesting clinical symptoms of A-avitaminosis also show marked pathologic changes in the teeth.

4. Histologic changes of the hard dental tissue due to vitamin A deficiency are as follows:

(a) The enamel presents no quantitative changes or structural defect, but there is unmistakable morphologic changes which consist of localized, circular or irregularly shaped spots or markings, accompanied by the irregular arrangement and course of the enamel prisms.

(b) The matrix of the dentin is properly formed, but the collagenous layer is increased in its volume, the calcification is improper and there appear many interglobular spaces due to the improper deposition and fusion of calcoglobulin spherules.

(c) Cementum undergoes central absorption and, in severe cases, the absorption may extend to dentin.

5. Changes of the soft dental tissues are mainly the circulatory disturbances:

(a) A marked enlargement of the vessels, and the vacuole formation between the odontoblasts and the pulp cells, occur in the pulp. A secondary edematous degeneration may also ensue. Especially interesting is the occurrence of metastatic calcification of Virchow in the pulp, as it is found in other organs of the body. Under certain conditions, the pulp cells may lose their original forms and transform themselves into absorptive tissues and thus bring about absorption of the dentin.

(b) No change other than marked hyperemia is demonstrable in the pericementum.

6. On the basis of the findings in the developmental imperfection of teeth due to vitamin A deficiency, the for-

mation of the teeth can be explained as follows:

(a) The fact that calcareous substance is found between the surfaces of the abnormally built enamel and the ameloblastic layer may be regarded as supporting the "secretion theory" of enamel formation.

(b) The demonstration of fine lattice fibrils connecting matrix and pulp greatly favors the fibril theory of Korff on the formation of dentin.

7. Changes in the maxillary bones consist of the enlargement of the haversian canals, interference with new bone formation, absorption, decalcification and wasting of bone tissue, and also congestion and fibrous degeneration of bone marrow. Moreover, there is an excess formation of osteoid tissue, which becomes adherent to the already formed bone, constituting additional formation.

8. The changes in the teeth and their investing tissues due to vitamin A deficiency may be considered as a type of osteomalacia. The changes in the teeth and in the maxillary bone are of the same nature, though they are far more marked in the former than in the latter.

9. The disturbance of calcium deposition should be regarded as the main cause of these changes.

10. Therefore, the function of vitamin A must be said to be closely connected with the regulation of calcium metabolism, acting as a kind of catalyzer and governing the deposition of calcium, but it also sometimes dislodges already deposited and fixed calcium, which is then metabolized into other tissues or excreted.

III. Changes in the oral and lingual mucous membranes of albino rats due to vitamin A deficiency.

When I first noted that oral and lingual mucous membranes undergo interesting changes, I proceeded to study them macroscopically as well as microscopically. The following results of this study may be mentioned:

1. Epithelium covering the mouth cavity, gums and tongue of albino rats fed on vitamin A deficient diet undergoes hyperkeratosis, atypical proliferation and heterotopia. Papillomatous changes were demonstrated in the gums.

2. A suppurative inflammation frequently occurs on the tongue.

3. The glandular cells of the salivary gland undergo atrophy and necrosis. The epithelium which lines the excretory ducts shows a marked cornification and often produces spherical masses of concentric stratified squamus cells.

4. These changes can be found even in young animals, and in a comparatively short experimental period (from forty-seven to seventy-three days).

5. The above described changes should be regarded as a part of the general changes involving the whole body, and the findings in the oral tissues correspond with those in other organs.

6. No carcinomatous change was found in the present experiment, but the data on hand are believed to throw some light on the formation of tumors in mouth and tongue. My findings in these locations are very similar to those in the gastric cancer produced in albino rats by feeding them on certain experimental diets, the work carried out jointly by J. Fujimaki and me at the Imperial Government Institute for Nutrition, and published in June, 1925. These investigations may be said to have revealed a new predisposing factor for tumor formation.

FUNDAMENTALS OF SUCCESSFUL ROOT CANAL TREATMENT*

By U. G. RICKERT, D.D.S., Ann Arbor, Michigan

FROM the events of the past year, it is evident that, while the great rank and file of our profession are fully conscious of the seriousness of the problem of the involved and the pulpless tooth, they are also aware of the necessity for the successful management of many such teeth by measures other than extraction. It is with this assurance that those of us who have large clinical and laboratory facilities are encouraged to continue our studies for a sane and safe solution of the problem. There are those who believe that preventive dentistry will relieve the situation, but the majority of us who have had experience with the application of preventive measures in general medicine realize that many generations will come and go before our problem will be noticeably affected as a result of prophylactic measures. In fact, it is highly probable that, as long as man exists as a human being with teeth, occasions will continue to arise on which it will be highly desirable to manage successfully teeth with involved pulps. We make this statement as one of the many enthusiastic advocates of preventive dentistry.

We are at this time concerned only with the fundamentals of our problem. No attempt will be here made to prove the advantages of one drug, preparation or method over others. There will be no reiteration of some of the essential details such as when and where to treat or the importance of aseptic precautions, for these are common knowledge. It is rather my purpose to call your attention to several fundamentals essential to success regardless of the methods used. I believe that no one has as yet presented operative procedures in our field that have been sufficiently well tried to deserve the unqualified endorsement of the profession. The proceedings of this session will be awaited with interest for there are a number of students of our subject whose work deserves the most careful consideration. We are on the road to certain success, but the question to be answered here is, have we arrived?

Fundamentals.—If we are to manage our problem most effectually, several erroneous conceptions rather general among both physicians and dentists should be revised. We have been thinking in terms of streptococci when, in realty, we should have been more concerned with the subject of intoxication as derived from several sources, to be discussed later. The idea that the solution of our problem is primarily a bacteriologic one is a wrong conception, for

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bacteria are of only secondary concern. Primarily, the management of the pulpless tooth is a problem in the field of biology and chemistry. Any technical procedures based on the former conception, without regard for the latter, are doomed to result in failure. This is in a measure true for the management of all infections. To illustrate: A large percentage of children, a larger percentage of adults, will not take diphtheria from the same ordinary contact that will produce the disease in the minority group. The offending organisms are identical in both cases, but there is a marked biologic difference in the two types of individuals. Similarly, the inadequate root canal surgery that involves the general health of one patient may be tolerated indefinitely by the more resistant types. It is essentially a difference of certain elements of the protoplasm. You will at once say that if my idea of the solution of the problem is correct, that is, if success is dependent on our ability to change the unfavorable to the favorable biologic states, we have as yet a long way to go. Fortunately our problem is unique in that the biologic factors that have been largely responsible for the past failures, chemical and physical trauma, can be controlled by suitable technic. While a complete inquiry would include the traumatic effects of certain operative practices of the present time on vital pulps, we are going to confine this discussion to the chemical and physical insults the vital periapical tissues have been subjected to with the past root canal surgery. The vital pulp problem will be presented in another section. When we speak of physical trauma we have reference to such conditions as excessive loads placed on many pulpless teeth with large restorations or to the ill advised over-instrumentation of the vital periapical tissues through the root canals. The clinical experiences with these practices have been so unsuccessful that it should not be necessary to discuss further physical trauma. We shall devote our limited time to a discussion of the several forms of chemical intoxication derived from entirely different sources.

The deleterious effects of powerful drugs on vital tissues has so often been referred to by many investigators that we will only undertake a brief review of this form of tissue destruction and then pass on to a second form of intoxication that is less understood and has been almost entirely overlooked. In our zeal to avoid infections, and with a lack of confidence in our ability to work aseptically, we have resorted to the use of powerful germicides and, in fact, defeated the very purpose for which they were used, in that they have so often prepared the field for subsequent infection by traumatizing and lowering the resistance of the vital periapical tissues. Even single antiseptics have often not been trusted, for there are still those who pin their faith to a conglomeration of powerful drugs. This practice has been so common that many of us still feel that intuitive urge just preceding the root filling operation to incorporate some antiseptic, such as iodoform or paraform, with a hope that it will destroy that lone bacterium that may have entered the canal during that fraction of a second while we were off guard winking the eyes. Such precautions probably at times do defer infection, but usually do more harm than good because when the germicidal effects have been dissipated, which must be the end result of all permanently diffusible

antiseptics, we usually have a field more susceptible to infection than it was immediately after pulp extirpation. Time will not permit a complete discussion of chemical trauma as induced by the injudicious use of drugs; but it may be worth while to remind those who have marveled at the years of service that many teeth have given after pulp extirpation by dentists who knew nothing about bacteriology, but who were by nature clean and careful operators, that those earlier operators fortunately did not feel the necessity for the use of powerful drugs. We have in our possession many radiograms of root-filled teeth treated in the days when bacteriology was in its infancy and dentists knew practically nothing about the subject. This is just another illustration of a treatment in which the remedy, as a result of a little knowledge, proved worse than the disease. We desire at this time to ask the following question and permit the reader to give his own answer: Why does it take weeks and months to produce an acute apical infection after extirpation of a noninfected pulp, and this with even the most flagrant violation of bacteriologic technic, provided there has been no instrumentation or use of drugs beyond the apex of the tooth? The answer is as simple as that to the question as to why it takes only a few hours at times to produce an acute abscess where one passes root canal instruments through infected pulp canal contents into the vital periapical tissues.

These facts are not presented to lessen your regard for aseptic surgery but to lessen your respect for the substitution of antiseptic for aseptic surgery and to call your attention to important fundamentals that have been almost entirely overlooked because our eyes have been too closely focused on details intended to destroy the formidable streptococcus without due respect for the adjacent vital tissues. Such details are essential, but we should remember that, while the tissue cells have some reparative and recuperative powers, they are effected by powerful caustics much as the finer mechanism of a watch or the delicate working parts of any fine instrument would be.

The second form of chemical trauma is active in practically all periapical infections even when the initial changes were caused by caustic drugs. It is the most important single factor concerned in the solution of our problem. We have reference to the intoxications produced by slow diffusion through the open system cementum and dentin present in the apical end of practically all teeth. The anatomy of the root end permits diffusion from the external circulation through the cementum and dentin to the vital pulp. These circulatory elements move with enough speed when both the circulation of the pulp and that of the peridental membrane are normal that the diffusion elements do not become toxic. If the normal pulp canal circulation is destroyed, the diffusion rate is unfortunately diminished to a point at which the circulatory elements become toxic to living protoplasm even in the absence of infection, as a result of lytic principles always present in the general circulation. By slow diffusion, such toxic substances again pass to the vital periapical tissues adjacent to the permeable cementum, initiating changes which in many cases later result in infection. The living dentin of the apical end of the tooth is not at all unlike the sapwood between the cambium layer and the heartwood

of the oak. If we destroy either of the approximate tissues without provision for the prevention of subsequent infection, we initiate tissue changes that finally result in death and decay. This is a fundamental that every dentist doing root-canal work should appreciate. Any results the operator may have had without due regard for this condition have been an accident and are not an evidence of skill. If all the cementum were impermeable, as it is between the gingivae and the apical third, the operation would be much more simple. All that would be required would be the sealing of the dentocemental junction with any nontoxic, insoluble material to prevent seepage. Our difficulties have been caused largely by the permeability of the apical end of the root. Both the clinical and experimental evidences favor the prevention of diffusion. The extent of permeable cementum can be roughly determined in pulpless teeth inadequately treated long since by observing the extent to which the apical end of the root is covered with either the hypercementoma or the misnamed granulomas. Both represent tissue reactions toward a toxic member. The latter may have been separated from the tooth during extractions; if so, the extent can usually be determined by the roughened denuded cementum. From our observations, it appears that the patients who can best develop this quarantine are the most resistant to the secondary effects of pulpless teeth. The fact that many of these misnamed granulomas are not infected but are richly supplied with leukocytes first suggested our studying the significance of this type of involvement. Establishment of these quarantines prevents the toxins, as such, from further diffusion.

The disregard of the diffusible area of the root end is the principal reason for many of the failures following root resection. No one, as far as we know, would think of making a resection without first refilling and sterilizing the canal. This precaution is highly important, but it is even more important that all of the diffusible area should be amputated and the resected apical plane impregnated with some substance to prevent further diffusion. This is doubly important during the healing process. If a silver solution carrying a maximum amount of the metal is reduced and burnished over the resected end and the byproducts removed, it is almost phenomenal how well the tissues react to teeth treated in this way. The failures of root resection are in the majority of cases due to faulty technic. Our methods for this operation have been described elsewhere.

The laboratory experiment that we are now to outline can be carried out by anyone interested in the root-canal problem. The object of this experiment is (1) to determine the extent of porous cementum on different teeth, and (2) to demonstrate measures that must be employed to reduce the diffusion rate to a negligible condition. Unless this can be accomplished, pulpless teeth will always seriously menace the health of those patients who are unable to build the defense by quarantines as described above. It has been our observation, which seems to coincide with Dr. Price's, that the typical arthritics seldom do develop such defenses.

Experiment.—Remove the pulp canal contents from freshly extracted teeth. Never use teeth that have become dry. Into the occlusal openings, cement tubular glass funnels made by drawing

glass tubing to a caliber that can be inserted into the occlusal opening. Any length tube can be used, but the funnel should be drawn so that the bore of the small end of the tube does not exceed 2 mm. The funnel is used to make possible the reduction of internal pressure of the tooth during the experiment. With a small hand magnifier, look for the foramina at the apical end of the tooth. Cover such foramina with a suitable insoluble cement. (We use Canada balsam, from which the solvent xylol has been evaporated to the point where the cement is but moderately flexible at room temperature.) One should now test the system, funnel and tooth for possible leakage. This can be done by placing the system in water, adding air pressure through the funnel and taking observations for air bubbles. If the system is secure, we are ready for the final tests. To facilitate the experiment, we can produce a partial vacuum within the pulp canals by means of the hydrant vacuum pump or the Elgin casting machine. After attaching the funnel of the system to one or the other pressure reducing machines, which is equivalent to adding pressure to the outside of the system, we are ready to place the tooth in a 10 per cent solution of silver nitrate. The experiment should be carried out in a dark room if possible; if not, the tooth and silver solution should be covered with black opaque paper to prevent silver reduction. After five hours of this increased pressure on the root with the silver solution, the tooth is washed and the system placed in direct sunlight for several hours. The funnel is removed and the whole tooth is ground on two sides to a thickness of 2 mm. You will now observe that the cementum, with the exception of the apical portion, prevented penetration into the dentin. In the apical region, the silver diffused to the pulp canal. This will be true even in the absence of the increased pressure, provided the tooth has been pulpless for a long time or more time is taken in the silver solution. Hereafter, we shall speak of this blackened area as the diffusible area of the tooth. If you will now take another tooth, identical with the first with the exception that the apical third of the canal has been carefully filled with some good adhesive root filling and repeat the experiment as performed on the first tooth, you will find that the silver failed to penetrate the cementum much, if any, further than it did in the cervical region. The reason for this is that the internal pressure in the latter case was equal to the external so that the diffusion rate became almost negligible. If the experimenter prefers to use direct pressure of 10 or 12 pounds, it can be done with but little more difficulty. In this event, a strong glass container of small diameter is required and a two hole cork, one for passage of the funnel, the other, to introduce the added pressure. The cork must be securely held in place or it will be forced out by the added pressure, with disastrous results to the experiment. Now as the best demonstration of our point, take a tooth which, from radiographic examination, appeared well filled before extraction, but which was known to be infected at the time of extraction. Repeat the experiment. On grinding this tooth, it will be evident that nearly all, if not all, have failed to seal either foramina or dentin and the silver will have permeated the dentin all along the canal to the crown of the tooth.

We have purposely gone into details in outlining this simple experiment because there has been so much criticism of one investigator because his technical procedures were always absent in his reports, so that others could not duplicate his work.

It is common knowledge that the vital tissues react successfully toward insoluble, nonporous substances such as some of the heavy metals. The metals that are not tolerated are sufficiently soluble in the circulatory elements to produce toxic solutions. That a porous organ, though like the apical end of a tooth, when deprived of one of its two sources of vitality should be tolerated by the adjacent vital tissues can hardly be expected in view of the changes that take place in the circulatory elements during the impeded diffusion period. One might as well believe that a wooden sliver forced into vital tissue would be as safely tolerated as a poorly filled root. Extensive clinical evidences and the limited laboratory evidences cannot at this time be enumerated in detail, but that the circulatory elements become toxic during the slow passage through the root end of a poorly filled root has been amply proved. The most striking evidence from a laboratory standpoint has been presented by Dr. Price, who insists that he has demonstrated such toxicity by the injection of laboratory animals with filtrates of macerated pulpless teeth. We have been unable to duplicate his results.

In view of the frequency with which incomplete laboratory data have been overstressed, and the reckless abandon of years of valuable clinical experience, one cannot pass without admiration the observations of some of the pioneer workers, Callahan, Miller and others, who so early, without a full appreciation of all the factors concerned, did recognize from clinical experience the necessity of a more thorough sealing of the lower end of the root canal. While laboratory evidences such as the experiments outlined above do give us a clearer conception of our problem, and do enable us to study fundamentals more directly than it could be done in the mouth, and while it does enable us to visualize more clearly the direct causes of our failures, we are also forcibly impressed with the value of long and painstaking clinical observation, which should always be a counterpart of laboratory results, as otherwise the work is not finished. Our failures have not been due to our not knowing approximately what should be accomplished in the filling of canals, but to the fact that, to date, there has been no operable technic by which the rank and file of dentists could successfully fill even the more easily filled canals. And finally the fact that the crudest method seemed to be tolerated led many operators to suspect that the importance of refined technic had been overestimated. The most pressing requirement of progressive dentistry for the time is a refined and more operable technic. This, in conjunction with more protection of vital pulps under restorations and a knowledge of the fundamentals concerned, will so reduce our failures that the pulpless tooth will cease to be a problem.

DISCUSSION

B. S. Hert, Rochester, N. Y.: Dr. Rickert has brought us today, as the result of his researches, one step nearer the solution of the pulpless tooth problem and has presented another reason why our root-canal work must be only the most thorough that our present-day knowledge affords. As stated, dentists have been thinking mainly of bacteria and

their destruction, in connection with treating pulpless teeth; but if bacteria are the usual cause of the death of the pulp, and the destruction of the tissue beyond when that occurs, and if they also, by metastasis, produce lesions or disturbances in more or less distant parts of the system, they can hardly be of secondary concern. And while we realize the importance of the biologic and chemical aspects of this problem, we feel that they are only part of the fundamentals to be considered, as the most careful attention to them will result in failure unless other fundamentals are treated with equal care. The treatment of a pulpless tooth is successful when the tooth is useful, painless and harmless to the balance of the organism; the most serious of these is the last, and therefore it is to the prevention of systemic effects that our efforts must be mainly directed. The first fundamental to be considered is when and where to treat. This knowledge is not so common, Dr. Rickert appears to think, nor is it so nearly to being complete as it should be. While many carefully, and some carelessly, filled pulpless teeth are, at least apparently, retained without harm to the individual, we know that, many times, the removal of such teeth is a benefit to a person, and we should have means of determining beforehand whether a pulpless tooth will be innocuous to the patient or not. While the family history, the physical condition of the patient and radiograms are a help, we need more than these, and a reasonably correct solution of this fundamental would materially help to solve the problem of the pulpless tooth. Asepsis is another fundamental, and its importance should be stressed at every opportunity. There probably is no surgical operation in which it is more difficult to keep the chain of asepsis unbroken, and failure to maintain it often means failure of the operation. When it is realized how comparatively few dentists have adequate sterilizing facilities for this work and how careless many dentists are regarding asepsis, it is not to be wondered at that local as well as systemic trouble often follows their treatment of pulpless teeth. All canals should be discovered and enlarged sufficiently to permit of being thoroughly filled. It is surprising how many dentists feel that the fine root canals can be sterilized and will remain innocuous even though unfilled. The one thing that Dr. Rickert's researches regarding diffusion demonstrate is that the apical portion of the canal must be completely obliterated, and with a material that will retain it in that condition permanently; otherwise the operation will not be a success. If canals cannot be filled in this manner, it is usually wiser to remove the tooth unless it is a case in which resection promises success. In view of the importance of the correct treatment of the pulpless tooth, the disinclination of many dentists, for various reasons, to undertake the treatment and the needless loss of many teeth on that account, it would seem that those dentists who are well qualified and adapted to follow this branch of dentistry should specialize in it. Special knowledge, skill and judgment are needed. A dentist busy with a general practice cannot measure up to these needs, and many of them would welcome an opportunity to refer such patients to a competent specialist. This would be to the ultimate benefit of the patient; which should always be our primary consideration. Dr. Rickert seems quite optimistic and appears to anticipate a rather early elimination of the pulpless tooth problem. We all hope that this is true for the sake of both the patient and the dentist. Preventive measures do now and will continue to lessen the problem in a well conducted practice, but I can see no early prospect of its elimination as so many people neglect to care for their teeth until one or more pulpless teeth are present. But with greater education of the people on the importance of maintaining the teeth in a healthy condition; with the large amount of research being conducted, as well as more and more careful clinical observation, we can expect, through these agencies, to reduce materially the number of pulpless teeth, and treat and fill many of those that are pulpless, with the assurance that they will be harmless to the patient.

THE UTILIZATION OF METHODS FOR THE PREVENTION OF MALOCCLUSION*

By A. C. ROHDE, B.S., D.D.S., Milwaukee, Wisconsin

NO doubt you will all agree that the majority of cases of malocclusion, accompanied with or without facial deformity, could have been prevented. What then, let me ask, are the active agents that have wrought this destruction upon so priceless a treasure as the human denture and have caused such outstanding facial deformity and disfigurement to patients as to threaten an otherwise successful career?

I believe that most cases are due to neglect, carelessness and utter disregard for the care of the deciduous denture and the first permanent molars. The greater part of this criticism must be laid at the door of the general practitioner of dentistry and the remainder to the ignorance and indifference of the laity.

One of the first symptoms of malocclusion in the deciduous denture is manifested at about the age of 5, by the lack of growth spaces between the incisors. The deciduous teeth are smaller than their successors and naturally occupy less space. This causes the permanent teeth to erupt overlapped and crowded. In cases that show lack of growth spaces, I would advocate expanding the arches to permit the erupting teeth to take their normal positions in the arch. (Fig. 1.)

Let us now consider the care that we as dentists should give to the temporary teeth. As in the permanent denture, caries is the tireless vandal with which we continually must cope. Not only does decay ultimately cause death of the pulp, with its accompanying infection and complications of a systemic nature, but it also destroys one of the main forces of occlusion, namely, loss of the approximal contact. Owing to the extreme bell-shape of the deciduous teeth, loss of the contact point causes a reduction in the size of the arch by several millimeters. In these cases, had the caries been discovered early enough, the normal contour of the teeth could have been preserved and the normal size of the arch maintained.

I have briefly mentioned the results of decay and its sequelae. On the other hand, no one realizes better than I that many, many deciduous teeth must of necessity be extracted long before the time for their normal shedding. I do, however, criticize the practitioner who considers his duty fulfilled when he has removed the offending member but has neglected to point out to the parents what the consequences will be one, two or three years hence, if the case is left untreated. This can best be illustrated in the case of loss of a second

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deciduous molar, for example, at the age of 7. (Figs. 2 and 3.)

The first permanent molar shifts

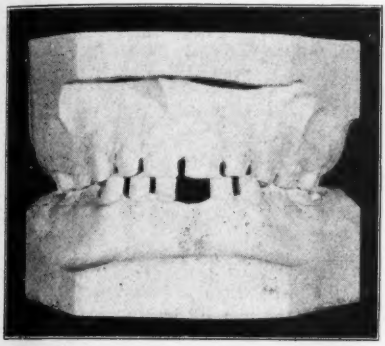

Fig. 1.—Model showing growth spaces between the upper and lower anterior teeth.

mesially, occupying the space of the second bicuspid, the second bicuspid occupying that of the first bicuspid and the

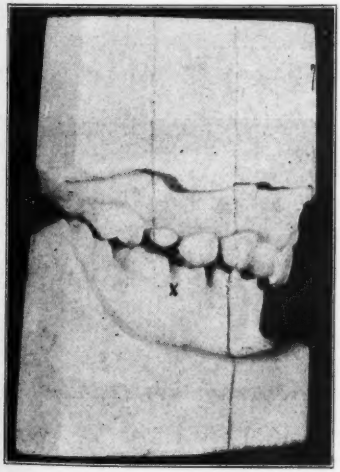

Fig. 2.—Model showing the mesial movement of the lower first molar closing the space where the second bicuspid should erupt (marked with a cross).

first bicuspid that of the cuspid. When the last named tooth erupts, it will nec-

Fig. 3.—Obstruction of the lower right and left bicuspids due to the early extraction of deciduous teeth.

essarily make its appearance inside or outside the arch or will remain embedded in the jaw. This progressive malocclu-

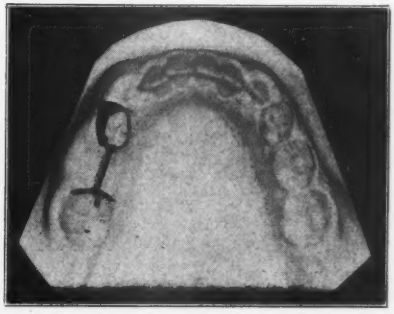

Fig. 4.—A temporary retainer after the loss of the second deciduous molar.

sion could have been prevented by the simple construction of a temporary retainer made by fitting a band on the first

bicuspid and a small clasp on the first permanent molar, and soldering a wire between. (Fig. 4.)

In cases in which several deciduous teeth must be extracted on either side,

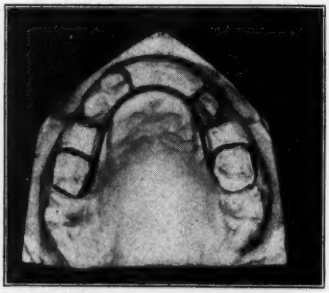

Fig. 5.—A lingual space maintaining appliance where several deciduous teeth have been lost prematurely.

a simple appliance can be constructed and cemented into place and the space maintained. Bands are fitted to the posterior teeth and a lingual arch is soldered in place. (Fig. 5.)

Small lugs are soldered at right

Fig. 6.—Model showing the mesial movement of the upper first molars, due to early extraction of the second deciduous molars.

angles to the arch wire and rest against the teeth anterior to the space to be retained. If dentists would but utilize this simple, inexpensive technic, I am certain that, in most cases, the result

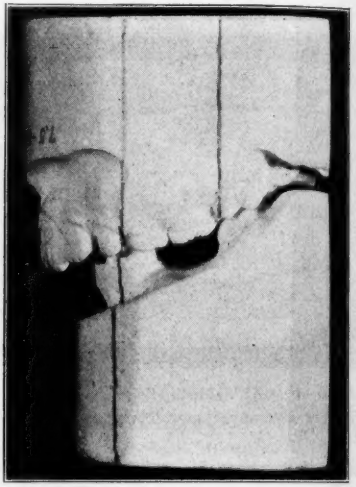

Fig. 7.—Model showing deep overbite due to early loss of the lower first molars.

would be an anatomically correct occlusion. In cases in which the second deciduous molar is lost before the eruption of the first permanent molar, there is no

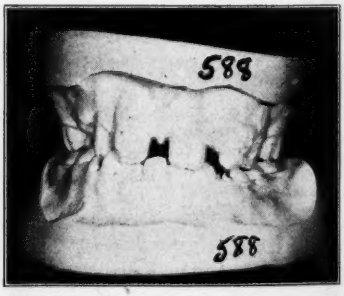

Fig. 8.—Model showing wide space between the central incisors, partly due to the abnormal attachment of the frenum.

way of retaining the space until the first molar erupts. (Fig. 6.)

While the early loss of the deciduous teeth is an important factor in producing malocclusion, so also is the prolonged retention of the deciduous teeth, although not to such an alarming degree. In such instances, the permanent tooth takes the path of least resistance, erupting inside or outside the arch or remaining embedded in the jaw. A roentgen-ray examination will readily

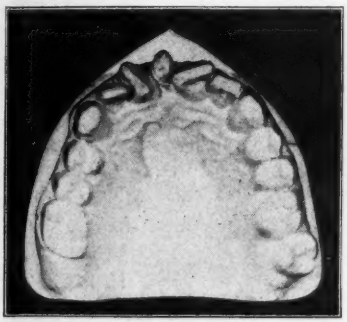

Fig. 9.—Model showing supernumerary tooth between the central incisors, causing malposition of the teeth.

disclose whether or not the deciduous tooth should be extracted. Statistics from the Milwaukee Health Department, according to Dr. Stephan, show that 48 per cent of all permanent first molars in children between the ages of 8 and 14 are badly decayed and, in a great many instances, must be extracted. This appalling condition is no doubt due, in great part, to the ignorance of parents, and the damage has already been done before the child visits the dentist. Loss of the lower first molars produces an extremely deep overbite, owing to the distal movement of the anterior teeth and the forward tipping of the molars. (Fig. 7.)

This, in turn, causes a marked facial deformity. The gnathion is too close to the subnasion, and there may be an arrested development of the chin. Loss of the upper first molars causes distal tipping of the bicuspids and mesial tipping of the second molar, resulting in what would seem to be a prognathic mandible but what in reality is an underdeveloped maxilla.

An abnormal attatchment of the

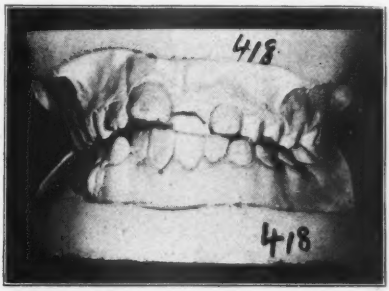

Fig. 10.—Model illustrating the abnormal relation of the inclined planes.

labium frenum is very common, yet very seldom noticed by the dentist until the wide space between the upper central incisors, which is so characteristic of this condition, is apparent. (Fig. 8.) Removal of the frenum is the proper treatment, and this usually falls to the oral surgeon.

The presence of supernumerary teeth commonly causes malocclusion. (Fig. 9.) They are usually discovered through clinical or routine roentgen-ray examination. In most cases, their removal is imperative.

The abnormal relation of the inclined planes is another factor that produces malocclusion. (Fig. 10.)

I believe that if children are under the care of a dentist and are observed closely during the time of eruption of the permanent teeth, this abnormal relation of one inclined plane to the other can be detected early and a small appliance inserted to guide the tooth to its normal position. When all the upper incisors are locked lingually to the lowers, we have the beginning of a case of mesioclusion.

Habitual mouth breathing has long been recognized as a cause of maloclusion. In such cases, the dentist, rhinologist and orthodontist should work hand in hand in order to correct the abnormal function of the nasal passages, lips and muscles.

Fig. 11.—Model showing protrusion of the upper anterior teeth due to thumb sucking.

Among the habits of children that produce malocclusion, thumb-sucking is probably the most pernicious. (Figs. 11 and 12.) While there are many devices on the market, such as aluminum and woolen mittens, adhesive tape and cardboard armlets, often it is impossible to cure the habit until the child can be reasoned with. Some of the other habits of children are lip-sucking, palming the chin, and "pillowing." All of these curb normal developmental forces and direction of growth and eventually impair the relation of the inclined planes.

This discussion of the various forces that affect normal development of the jaws would not be complete without brief mention of proper diet, which will provide the necessary food elements if the masticating apparatus has functioned normally. Parents cannot be urged too strongly to give careful attention to this factor in the child's welfare.

Fig. 12.—Profile view of child showing marked depression of the mentolabial sulcus due to thumb sucking.

CONCLUSION

Let me impress upon you the importance of (1) the preservation of the entire deciduous denture and the first permanent molars; (2) the retention of

space where the extraction of deciduous teeth has been necessary; (3) the recognition and, if possible, the prevention of abnormal habits; (4) treatment of the abnormal frenum; (5) a complete roentgen-ray examination, and (6) proper diet.

Prevention of malocclusion is a matter of education among both the dental profession and the laity. If the above mentioned conditions are recognized early and prevented, we will have rendered more real service than can be accomplished by treatment after malocclusion has become established.

DISCUSSION

J. B. Kohagen, Duluth, Minn.: Before reading Dr. Rohde's paper, I thought, from the title, that some mechanical devices would be offered as an aid in the prevention of malocclusion for our patients. So we may regard it as a coincidence that Dr. Rohde had stressed the very point that I had in mind, the education of the general practitioner and layman in the early intervention and treatment of malocclusion. Every orthodontist, no doubt, has recognized the lack of orthodontic information possessed by the average general practitioner; for had the majority of our patients had orthodontic treatment early in life, far better results could have been attained, with a minimum of discomfort, and time and financial loss to the parents. I think we, as individuals, should bring our teachings to our local dental societies by presenting papers and clinics, instead of feeling that the general practitioner is not interested in orthodontia, and thereby impress on the societies the advantages of early treatment. I believe that teaching the general practitioner and layman a few of the truths about orthodontia instead of letting them fall in the hands of commercial laboratories would be of more value to our patients than continuing the attempt to perfect our mechanical apparatus. I think we are as much to blame as our brother practitioner in keeping helpful information from him. For some unaccountable reason, a great many dentists feel that a deciduous set of teeth is of no particular value. They seem to reason that the teeth will soon be lost, and that restoration or mechanical interference is of no particular value; that, with a fair amount of luck, the individual will receive a permanent set of teeth in good occlusion. Too much stress cannot be laid on the care of the deciduous teeth as pointed out by Dr. Rohde. Quite frequently, the loss of a number of deciduous teeth, or possibly one or two first molars, makes it extremely difficult to institute treatment before the eruption of some of the other permanent teeth, and much valuable time is lost before corrective measures can be applied, when early expansion of deciduous arches is indicated. Commercial laboratories seem to sense a lucrative field in the practice of orthodontia, offering to the general practitioner a certain type of apparatus that they assure him will correct his cases of malocclusion. We in the specialty know that no one type of apparatus is applicable to all cases of malocclusions, the contrary being true, i. e., we must design the type of apparatus that is indicated for the case to be treated. I feel that the general practitioner should not attempt to treat only the simple cases of malocclusions, for I am sure that we who practice the art as a specialty, if we are honest with ourselves, must admit that about ten years is none too long to practice before we can treat and forecast orthodontic results with any assurance. As to the evils: (1) the loss of contact; (2) force of incline planes due to decay; (3) atmospheric pressure due to abnormalities of nose and throat; (4) inharmony in the size of arches due to mutilation and improper maintenance of spaces; (5) muscular pressure due to abnormal habits, diet and general care of teeth; I am sure that we are in accord with Dr. Rohde.

In closing, I wish to compliment Dr. Rohde on his able presentation of this phase of our work. If we have been stimulated to pass along to our brother practitioners the information here gained, a growing generation will be benefited.

SELECTION OF DENTAL FILLING MATERIALS*

By A. E. WEBSTER, D.D.S., M.D., F.A.C.D., Toronto, Canada

THE chief reason for filling teeth is to restore and maintain health and the esthetic appearance.

During the past fifty years, a new filling material or a method of filling teeth has been added to the armamentarium in each decade. As the number of materials increases, the difficulty of making a selection increases. As each material forces its way into general use, it is evidence that there is no one best or universal filling material. Filling teeth is not the performance of a mechanical procedure identical in all cases, but the meeting and solving of a pathologic problem by suitable therapeutic agencies. Neither the physical nor the pathologic condition is always the same. Each patient, each set of teeth and each tooth must be met and dealt with on a basis of all the factors present, general and local.

The selection of filling materials for cavities in human teeth, like all other problems in life, is only simple to those who know little about it. Too often, the selection is based on the convenience of the operator and on the pocketbook of the patient. Gold, and even platinum, sometimes appears where no filling should be. Cements and all silicates have a place in some practices out of all proportion to their value as filling materials.

There are so many factors to be taken into consideration in the selection of filling materials that one hesitates to do more than mention a few general principles. While the age of the patient is of assistance in selecting a filling material, it is not the age in years, but the physical and mental status that the age indicates that helps to guide in the selection. There are critical periods in life indicated by age that force one to select certain methods of operating. Decays in the teeth of childhood, adolescence, early manhood, middle life, old age, senility, cannot all be treated alike and the best service be given the patient. Sex is of importance, because the female has periods in life in which she is not so well able to bear tedious dental operations as at others. No dentist would select the period of adolescence, menstruation or pregnancy for long, painful or tiresome operations, such as gold foils entail.

Sometimes, the mental state of patients is such that dental operations are not indicated at all. Such states as insanity, hysteria, epilepsy and subnormal mentality make plastic filling materials the only recourse. Filling materials should be as much suited to the mental state of the patient as to the physical. I once saw an epileptic who had broken several of his front teeth during seizures.

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

A young dentist, without inquiry, restored them with crowns, only to see them all broken to pieces at a subsequent seizure.

Filling materials should be selected in accordance with the state of health of the patient. Those suffering from acute infectious disease, such as typhoid, rheumatism and exanthemas, sometimes needs to have teeth filled, but no one would use gold in such cases.

Patients suffering from long wasting diseases should have fillings inserted that will give the best service to them for the time they have yet to live. The fact that patients suffering from tuberculosis, diabetes, or pernicious anemia may have nothing to do and plenty of money is not a good reason for making large gold operations. There is no sense in filling with gold foil the teeth of an old man who has angina pectoris. Dentists should learn the lesson that a service must be suited to those receiving it. Because one person gets excellent service from amalgam fillings, it does not necessarily follow that everyone having amalgam fillings will get equal service.

It is often said that, in matters of health, there can be only one kind of service for either rich or poor, and that is the one demanding the greatest time and skill. This may be the ideal, but it does not work out that way. In dentistry, and especially prosthetics, the patient who can pay high fees gets the best service. Therefore, in the selection of filling materials, the patient's ability to pay will have some influence, but not nearly so much as some dentists would wish their patients to believe. To ask a patient to pay $15 for a gold filling and $2 for an amalgam filling for the same cavity is humbug. The difference in cost of material is less than $1, while the time and skill required are often greater with amalgam than with gold.

The station in life has much to do with the selection of filling materials. Gold crowns, gold fillings and even amalgam fillings have a place in anterior teeth in some special cases. In some cases, it would be a waste of time to insert porcelain fillings; while in others, nothing else would be so serviceable.

The character of food used often influences the selection of filling materials. The common use of tenacious gritty foods will dislodge or wear away fillings. Cements often have a very short life in some mouths; while they give excellent service in others.

A careful study of the power of mastication, as shown by the condition of the teeth present, will influence the selection of filling materials.

The extent and character of the destruction of the crowns of the teeth, whether by caries, traumatism, wear or solution, determine in a large way the kind of filling material to employ. Loose, drifting, elongating teeth, and those out of occlusion are best served by fillings other than gold foil.

In the past, chief attention has been given to the physical property of filling materials and tooth structure, as a basis of selection. Too often, fillings have been inserted without any thought being given to the physical or mental condition of the patient or to the state of the peridental membrane. As long as the filling would not break, wear away or fall out, every purpose was thought to be served. Filling materials have been selected as if all patients were alike, as to age, sex, mentality, physical structure, occupation and health. Dentists are today treating more sick patients

than ever before, so the rules laid down in the past do not apply now.

Many here would perhaps be disappointed if I should close without laying down some positive rules, stating exactly when and where to use each filling material. To attempt to do so in detail would discredit your intelligence, and yet there are some general rules which may guide.

Notwithstanding the introduction of many filling materials during the past three or four decades, cohesive gold foil still stands as the filling par excellence in properly selected cases. Small, inconspicuous cavities in anterior teeth of adult healthy patients which can be filled and finished in a reasonable time should be filled with gold foil.

Pit and fissure cavities in molars and bicuspids are most satisfactorily filled with gold foil.

Gold inlays have taken the place of gold foil in all large cavities reaching close to the pulp in delicate patients with weakened periodontal membranes, especially in proximal surfaces of inconspicuous teeth. Conspicuous teeth may be well filled with gold inlays, which are faced with either silicate or porcelain. The gold inlay is well suited to cavities in the teeth of young patients in whom the enamel is friable or tends to dental caries.

It is said by many operators that silver amalgam saves more teeth than all other filling materials taken together. Whether this is true or not, it may be safely said that silver amalgam is in more general use than any other material. This in itself is an indication of its value. Its use is indicated in large cavities, difficult of access, in inconspicuous locations in teeth that tend to decay.

SILICATES

The silicate filling has found a place in dental practice far beyond its merits. Its chief value is in its harmony in color with tooth structure. It may be used to advantage in exposed cavities in anterior teeth, facings for gold inlays and repairs for crowns. It should not be used in proximal surfaces of anterior teeth of the young if it is expected to retain the contact.

COPPER AMALGAM

Copper amalgam has been a long time in use and has won for itself a very limited place. It has two objectionable properties: it dissolves in the fluids of the mouth to a small extent, and discolors the tooth. Its therapeutic value is the chief reason for its use. It is indicated in cavities in posterior molar teeth, especially distal and buccal cavities in third molars and any cavities in deciduous molars.

OXYPHOSPHATE CEMENTS

The oxyphosphate cements are gradually being displaced by the silicates as filling materials. They must be looked on as very temporary as filling materials. They are, however, the most valuable materials in dental practice.

PORCELAIN

Porcelain inlays are valuable in any location where they can be inserted. They find their greatest use in large exposed cavities in anterior teeth.

TIN

Tin as a filling material has almost gone out of use. A few operators use tin and gold foil in deep occlusal cavities.

Guttapercha, like tin, has almost gone out of use as a filling material.

DISCUSSION

R. D. Thornton, Richmond, Va.: Dr. Webster has approached his subject from an angle somewhat different from that which might be anticipated. He has, however, dealt with some very important problems in the selection of dental filling materials. Two statements in the early part of his paper should be emphasized. The first refers to the increasing number of filling materials on the market as an indication that there is "no one best or universal filling material." The old idea that gold foil or some other material is the best should be abandoned. There is a best filling material for each case; and it is the duty of the dentist to study each case and select the filling material indicated. His second statement, "Filling teeth is not the performance of a mechanical procedure identical in all cases, but the meeting and solving of a pathologic problem by suitable therapeutic agencies," should also be carefully considered. The material used for the restoration may play an important part in clearing up conditions in a mouth susceptible to caries or it may aggravate the conditions in a mouth suffering from peridental lesions. Reference has also been made to different periods of life and to sex. The filling of deciduous teeth has always been a much neglected subject. With present-day knowledge of the important rôle played by these teeth in the physical development of the child, much greater care should be given to the choice of material used. So many cement and amalgam restorations are inserted in the deciduous molars without regard for occlusal contour, for contact point or smooth continuity from filling material to tooth tissue at the gingival that the child is irritated by gingivae lesions due to foreign filling materials or to the impaction of food. Such conditions lead to faulty habits of mastication, and tend to produce unclean areas in the mouth. Much better contour can frequently be obtained by using inlays than are made with plastic filling materials. This may appear extravagant in the eyes of some operators, but the period from 4 to 14 years of age is one of the most important decades of of life from the standpoint of efficiency in mastication. The cost of any restoration should be spread over the period of time that the restoration is intended to serve and not charged up against the immediate date of insertion. It is false economy to insert amalgam or silicates in teeth when the stress of mastication is too great for them to withstand. A little greater expenditure at the time would pay for the insertion of an inlay that would have sufficient edge strength to resist the force exerted on it for a much longer period of time. Patients whose oral conditions indicate a marked susceptibility to caries should have materials inserted that can be highly polished and easily cleansed in the mouth. There is, perhaps, no other problem in dentistry that requires such careful attention and good judgment as is necessary when a patient has rampant caries. The fact that decay has recurred around restorations previously inserted should not be considered an excuse for using materials that are not indicated as the best for that particular situation. Dr. Webster's reference to the state of the peridental membrane should be seriously considered in making restorations that affect the occlusal surface or require the use of force in their insertion. Alloys that will not wear down or flow under the stress of mastication should not be used in teeth with impaired pericementum unless patient and operator have a distinct understanding that frequent adjustments will be made to avoid traumatic occlusion. I believe that Dr. Webster's statement "pit and fissure cavities in molars and bicuspids are most satisfactorily filled with gold foil" should have been prefaced by the word "some." Small pits easy of direct access may be filled with foil, but when large fissures in the posterior teeth, especially second and third molars, become involved, the gold inlay or amalgam restoration can usually be inserted, contoured and polished to better advantage. Silicate fillings have been brought into discredit largely by the injudicious use of them. The field where they are indicated at present is very limited. Much improvement seems to have been made in their qualities since their introduction. Because of their easy manipulation, from the patient's point of view, and their pleasing colors, they seem destined to play an important part in dental restorations. If cavities are properly selected and the materials carefully manipulated, there seems to be sufficient justification for continuing their use, with the hope that the manufacturers will improve further on their lasting qualities.

ONE OF THE FUNDAMENTAL FACTORS CONCERNED IN THE ETIOLOGY OF DENTOFACIAL DEFORMITIES*

By MILO HELLMAN, D.D.S., New York City

THE task involved in the search for knowledge concerning the elements that enter into the complex of etiology is a difficult one, since no cause, however simple, always remains a cause. As soon as sufficient knowledge is gained about the nature of a cause, the aspect changes, and the cause becomes an effect of some other cause. As a result, the problem of looking for causes is extremely elusive. The nearer it is approached, the further it seems to recede.

The realization of this situation renders the task insuperable. There is, however, one redeeming feature, at least, as far as orthodontia is concerned; namely, the problem may be approached from a different direction. It is known, for instance, that dentofacial deformities are curable by the use of certain stimuli furnished by mechanical contrivances. Mechanical stimulation promotes development. It may then be reasonably assumed that the deformities in question are due to forces that interfere with development. In order, therefore, to attack the problem in a systematic way, it would be necessary to know (1) the effect of natural development on the dentofacial regions; (2) in what manner dentofacial deformity differs from the natural product of development, and (3) the reason for the difference.

I have adopted this method of procedure and the results so far obtained seem to be very promising. In a paper read at the First International Orthodontic Congress in New York last week, the first phase of this task was covered. The results of an elaborate investigation of the problem of development as it affects the human face was reported, the outcome of years of research at the department of Anthropology, American Museum of Natural History in New York. Though the details of the facts revealed are of importance, under the restriction in time only a cursory review can be given.

This study was made on a skull collection of a homogenous group of ancient American Indians, dating back at least 2,000 years. It consists of a number of skulls comprising a complete range of those ages representing the various stages of development from early infancy to senility. In my search for the necessary material for such study, I have yet to see a more suitable collection than this one group represents. The findings in this study were supplemented by facts derived from other skull material and from a large group of living individuals. The facts revealed were classified in accordance with the best scientific knowledge of today.

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

Thus, before entering on the examination of the facts, the modern biologic concept of development is discussed. In it, the point is made quite clear that development as it is understood today, is a term used to designate several processes. The processes referred to by the term development may be grouped under two captions: those of growth, meaning increase in size; the others, of differentiation, meaning increase in complexity. Development, therefore, depends on both, growth and differentiation; i.e., on increase in size and on increase in complexity. The egg and the hen are an example of it. It is also shown that growth is at the bottom of differentiation, too, since growth, in certain particular directions, may affect changes in form. The growth of bones may be used as examples of morphologic differentiation. For instance, as the long bones continue to grow, bone is deposited on the surface of the shaft, but, at the same time, it is removed in the marrow cavity. The jaw bones, too, present an example of this kind. The well-known and classic madder experiments on the growth of the jaw bones of pigs quite clearly emphasize this point. Then, too, as the human maxilla increases in size, the nasal aperture and the maxillary sinus become larger. This, no doubt, is brought about by readjustments in form, which, in turn, may be due to change in proportion brought about by growth in certain particular directions. It is, therefore, apparent that the study of development fundamentally depends on an understanding of growth.

Table 1.—Particulars in Which a Class II Division 2 Case Differs from the Remainder in the Child Group

			Group		
			Class II	Mean	S.D.
Height	1.	Total face	105	88.35	6.85
	2.	Upper face	62	53.34	3.51
	3.	Symphysial	29	24.00	0.93
	4.	Nasal	45	38.01	2.43
	5.	Mandibular	25	19.29	1.75
Width	1.	Bizygomatic	117	104.25	3.03
	2.	Bimalar	92	82.50	4.60
	3.	Nasal	24	21.90	1.14
	4.	Interorbital	25	18.00	1.53
	5.	Palate (max.)	38	34.68	2.85
	6.	Condylar	105	95.70	6.20
Depth	1.	Posterior palate	10	8.55	1.23
	2.	Basal mandibular	69	62.32	3.93
Position	1.	Aural-nasal	85	76.63	4.11
	2.	Posterior-superior (border line)	82	78.54	3.33

The study of growth as pursued by the biologist is again, usually, based on an understanding of the phenomena connected with the increase in weight of an organism. Since weight is a function of height, the taller an organism is, the heavier it must be; or conversely, the heavier, the taller. Weight also carries with it the idea of bulk. A study in the development of the human face cannot be gaged by weight: bulk must be included. Estimations of bulk had to be made by means of meas-

urements of dimensions. The measurements made were those of height, width, and depth. In addition to these, measurements were also made to indicate changes of angles, such as the facial, alveolar, gonial and mental, and changes in position of the face in relation to the cranium. For this purpose, anthropometric methods were employed, in addition to which other measurements had to be devised. The measurements had to be brought in relation to time in order to estimate how much growth takes place and in how long a time. The time scale used in this instance was based on physiologic manifestations. I, therefore, call it the physiologic time-scale. The facts brought out by these measurements are of considerable interest. In a brief summary of the findings, it may be stated that the human face, during the course of development, goes through a series of changes, produced by increases in size of various dimensions.

TABLE 2.—PARTICULARS IN WHICH A CLASS III CASE DIFFERS FROM THE REMAINDER IN THE ADULT GROUP

			Class III	Group Mean	Group S.D.
Height	1.	Subnasal	28	22.00	3.06
	2.	Mandibular at M1	65	60.41	4.65
	3.	R. Ht. (Coronoid)	70	62.41	5.88
Width	1.	Interorbital	25	21.80	1.86
	2.	Palate (max.)	40	42.53	1.98
Depth	1.	Palate	6	10.59	3.78
	2.	Mandibular (total)	88	82.50	4.35
	3.	Ramus	53	49.42	3.66
	4.	Basal mand.	88	79.39	5.01
Position	1.	Aural-nasal	83	88.55	5.35
	2.	Aural-mental	124	113.85	7.40
	3.	Aural-posterior-inferior	108	100.85	4.50
Angle	1.	Gonial	112|119	117.39	5.58
	2.	Facial	80	84.86	2.34
	3.	Alveolar (border line)	58	62.20	5.00
	4.	Mental (border line)	63	68.65	5.99

1. *Changes in Total Height.*—These changes are due to increase in this dimension from early infancy to old age, after which there is an actual considerable decrease.

The total face height is attained by: (a) a moderate increase in height of the upper face; (b) a moderate increase in height of the lower face; (c) a greater increase in the interval between the upper and the lower face by the development of the dentition and its supporting structures.

Thus, while the upper and lower face keep on growing, the dentition comes in between them and pushes them apart, so to speak, thereby increasing the total height at a higher rate than the amount of actual growth the upper or the lower parts contribute.

2. *Growth in Width.*—This is attained by actual increment in the median plane and by a sort of additional widening in the posterior, in the lateral and in the inferior regions. Thus, there is:

(a) a moderate increase in width in the median plane posteriorly (posterior nares); (b) a somewhat greater increase in width in the anterior region (interorbital, nasal); (c) the greatest increase in width of the lateral halves, taking place posteriorly at the mandibular angle; (d) intermediate increases in the posterior region from the gonion upward, and, laterally, from the gonion forward.

really growing backward and not by growing forward. But as the facial structures grow backward, the facial mask migrates forward. This forward movement is greater in the mandibular region than in the maxillary regions. In other words, as the face grows backward, it, in a manner of speaking, swings forward.

The last changes that may be mentioned are associated with the angles—

TABLE 3.—PARTICULARS IN WHICH A CLASS I CASE DIFFERS FROM THE GROUP

			Class I	Group Mean	S.D.
Height	1.	Total face	101	116.90	9.70
	2.	Upper face	63	72.05	5.00
	3.	Nasal	43	48.90	4.80
	4.	Symphysial	28	34.00	3.45
	5.	Dental	9	13.31	1.41
	6.	Sigmoid notch	11	12.80	1.33
Width	1.	Bizygomatic	123	129.54	6.03
	2.	Bicuspid (upper)	36	39.87	2.22
	3.	Nasal	24	26.00	1.73
	4.	Bicuspid (lower)	31	35.20	2.85
	5.	Gonial	89	94.65	5.15
	6.	Lower alveolar arch	62	69.60	4.11
Depth	1.	Palate	40	45.19	4.02
	2.	Total mandible	76	82.50	4.35
	3.	Preramus	43	49.42	3.66
	4.	Basal (mandibular)	74	79.39	5.01
Position	1.	Auriculomenton	106	113.85	7.40
	2.	Auriculo-posterior-superior	89	95.57	4.35
	3.	Auriculo-posterior-inferior	92	100.85	4.50

Thus, the face increases in this dimension by widening in the median plane. But, in addition to this, there is also a spreading of the facial mask from behind and below.

3. *Growth in Depth.* This growth is attained by (a) increase in size in an anteroposterior direction; (b) increments posteriorly to the previous existing part; (c) a higher rate of increase in the mandibular portion than in the maxillary portion.

The face then grows in depth by

the facial, the alveolar, the mental and the gonial. The angles are shown to change in an opposite direction to the other measurements. In other words, as all other dimensions become larger, the angles become smaller.

This part of the investigation throws some light on the matter of development as it affects the face. Of course, it is needless for me to state that the procedure followed in this study to get at the facts is the quantitative method used in biostatistics, known as biometry. The

facts discovered are, therefore, of a quantitative value, and may be explained in terms of numbers. Thus, we may say that at a certain stage of development, say, at the stage of early infancy, the mean height of the total face (from nasion to menton) is 66.27 mm. At a later period, the same height is 77.80 mm., and so on. But we know that in the number of cases in each developmental group the individuals vary. It is, therefore, customary, in statistics, to express in numbers also the extent to which the individuals vary. For this purpose, use is made of the standard deviation, which, when following the means of a series, indicates the amount of spread of the type in which a certain dimension is expressed. The standard deviation thus embraces 68 per cent of the number measured or weighed. Thus, the mean plus or minus (±), the standard deviation (S.D.) may be used as a norm for a certain purpose.

For example, if we measure the height of the individuals in this room, we may find that the mean in height is 67 inches, with a standard deviation of 3 inches. We can use this as the norm for this particuar population. Anyone being less than 64 inches or more than 70 inches in height may be considered as outside this norm, or abnormally tall or small.

In ascertaining the dimensions concerned in the growth study of the face, the results are similarly based on the mean and standard deviation of the measurements taken. But in this, as in the case of measuring the stature of the people in this room, not all the meas-

TABLE 4.—PARTICULARS IN WHICH A CLASS I CASE MAY DIFFER FROM THE GROUP

			Class I	Group Mean	Group S.D.
Height	1.	Total face	137 mm.	116.90	9.70
	2.	Upper face	85	72.05	5.00
	3.	Nasal	58	48.90	4.80
	4.	Subnasal	27	22.11	3.06
	5.	Symphysial	39	34.00	3.45
	6.	Mi region (mandible)	33	29.67	2.33
	7.	Palate	17	14.41	1.57
	8.	Condyle	66	60.41	4.65
	9.	Coronoid	70	62.41	5.88
Width	1.	Bimalar	107	98.60	5.50
	2.	Palate max.	45	42.53	1.98
	3.	Lower alveolar arch	76	69.60	4.11
Depth	1.	Upper alveolar arch	52	48.69	2.91
	2.	Palate (total)	50	45.19	4.02
	3.	Palate to suture	40	35.14	2.79
	4.	Preramus	54	49.42	3.66
	5.	Basal mandibular (length)	85	79.39	5.01
Angles	1.	Facial	89	84.86	2.34
	2.	Alveolar	68	62.20	5.00
Position	1.	Aural-nasal	95	88.55	5.35
	2.	Aural-mental	125	113.85	7.40
	3.	Aural-posterior-superior	102	95.57	4.35
	4.	Aural-posterior-inferior	107	100.85	4.50

urements taken fell within the range of the standard deviation. Were they all normal? By no means. Can the normal be distinguished from the abnormal in the measurements recorded? The answer is furnished in Table 1. In this table, a comparison is made of the number of instances out of forty-six facial measurements, in which a Class II, Division 2, case differs from the rest of the group measured. The dentition in the rest of the group is in "normal" occlusion. It is of particular interest to note that, outside the teeth, which are intentionally omitted, there are fourteen points of difference and one borderline instance. It is also interesting to note that, in all these instances, the difference is beyond the plus side of the standard deviation. Attention must be directed to the outstanding features; namely, that in the development of the face in this case, the process has gone beyond the normal limit in the case of the features enumerated; but, among them, it is interesting to see the upper face, especially the nose, which is both higher and wider than the normal. The mandible, too, is both higher and longer in the body portions and wider in the ramus region. The maxilla is higher and wider, and the palate, wider and deeper. The fact must not be overlooked that, while fourteen characters are larger than the norm, the thirty-two remaining are within the normal range of variability. That means that the differences are all above normal, or hypernormal.

Another interesting example of this kind is presented in Table 2, representing comparisons of a Class III case and the group from which it is taken. In this table are recorded the number of characters out of the forty-six that are different from those of the rest of the group. Note that the characters exceeding the measurements of the group are the subnasal, mandibular and ramus in height; interorbital in width, and mandibular in depth. In position, the upper face is subnormal, while the mandible is hypernormal. The angles are all below the normal of the group, except the gonial angle, which is extremely asymmetric.

A similar analysis of two Class I cases (Tables 3 and 4) also shows the same kind of differences of certain particular characters; i. e., they are either below (Table 3) or above (Table 4) the norm of the group. It is, at this time, impossible to go into further detail regarding the manner in which conditions of malocclusion differ from the norm of the group. More will be published soon. The cases shown appear to point the way toward the inference that the conditions responsible for cases of malocclusion are somehow connected with modifications in the processes concerned with development. In the one instance, as in the case presented in Table 4, development fails to be checked and goes beyond that of the norm for the group. In the other (Table 3), it is checked too soon, and does not quite reach the norm. The reason for either is as yet difficult to explain. The problem will remain an enigma until more is known about those natural factors that are concerned with the stimulation, inhibition or modification of those vital activities that bring about the phenomena designated by the term "development."

TEACHING OPERATIVE DENTISTRY*

By RALPH R. BYRNES, D.D.S., F.A.C.D., Atlanta, Georgia

OPERATIVE dentistry would seem to be the background of all dentistry, from which all other phases have emanated as branches. In latter years, various of these branches have risen to the importance of the just claim that they be known and practiced as specialties. The field of specialties has so increased, however, as to leave doubt in the minds of many as to just what constitutes operative dentistry. While I shall not here attempt dogmatically to lay down a definition of the term, I shall say that my treatment of the teaching of the subject will be in its broadest sense and contradistinctive to the older specialties of prosthetics and crown and bridge work.

The first instruction begins with lectures and recitations in dental nomenclature. This is learned thoroughly. Each student is required to know all of the terms and their meanings, together with a general description of the teeth and the location and form of all of their surfaces, using a prescribed textbook as his guide. All terms are thoroughly explained by the instructor in charge, with the aid of drawings and charts. This gives each student a clear mental picture, thereby enabling him to comprehend and to remember.

The first requirement in laboratory technic is that each student shall prepare modeling compound blocks in the form of quadrangular prisms of suitable size made from a selected modeling compound, using a Boley gage for measuring. Each student is required to complete a full set of thirty-two, after which they are passed upon by the instructor as to whether they are suitable for use in carving the set of compound teeth. With an illustration on the blackboard, each tooth is taken up separately. At the same time, each student is required to make notes of all diagrams and explanations, keeping these constantly before him while carving the tooth.

A compound block is selected by each student, and, with the aid of his notes, he follows a definite line of procedure; for example, each student makes his own diagram showing different cuts to be made in the carving of a tooth. He is required to remain in his seat where ample instruction is given individually by the instructors in charge of the class. At this time, details are gone into and explanations made. This regular procedure is carried on day after day, a different tooth being taken up at each class until the full twenty-eight are carved in modeling compound.

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Quizzes are given at different intervals, refreshing and familiarizing the class with the nomenclature.

The next requirement is for the class to carve a full set of teeth from bone blocks. By that time, the students have developed to the point where they begin to appreciate the value of tooth carving. The same general method of procedure is followed as in the carving of teeth from modeling compound. From his previous experience, the student learns that, once he gets the block cut to a rough outline, it is then comparatively easy to bring out details and finish it, after which the teeth are polished, articulated and turned in for proper credit.

Each student is required to carve twenty-eight teeth in bone. These are used the following year in the sophomore class for cavity preparation and general operative technic work of all kinds. Needless to say, this course in carving is designed to acquaint the student thoroughly with the anatomic forms of the human teeth.

Next, the freshman class is taught the instrument technology of Black's university cutting set. Hexagonal brass rods are used in making models of Black's cutting instruments. Careful instruction is given the student on the name, formula and use of each of the forty-eight instruments included in the university set. Instruction in this department of the work is designed to prepare the freshman class for practical work; but, in addition, it is of inestimable value in training the eye to the observance of the minutiae of detail and in developing in the fingers the delicacies of touch.

Next, the students are required to dissect and trace all root canals, and to study the general anatomy of natural teeth, making cross, longitudinal, mesiodistal and labiolingual sections. This gives them a general idea of the thickness of the enamel and of the dentin, the shapes of the different pulp canals and the location of the horns of the pulp. When this study has been completed, the students are required to mount the tooth dissections and review the technic that has been carried out.

Students are also required to make complete drawings of all teeth of one side of the mouth, with the exception of the third molar. Thus, they complete fourteen drawings of whole teeth. These drawings are made three diameters in size. In addition, two or three sections of each upper and lower tooth (with the exception of the third molars) are drawn. The section drawings are made on the natural scale. Considering both the entire and the sectional drawings, approximately forty-two drawings are required of teeth alone, during the semester.

A general review of the requirements of the freshman class comprises the following:

1. Carving a full set of teeth from modeling compound.
2. Carving a full set of teeth from bone blocks; reproducing all cusps, grooves, ridges and fossae of the teeth, then mounting and articulating.
3. Dissection of the teeth, removal of dental pulps, cleansing and tracing of the pulp canals, this familiarizing the student with the number of roots, curvatures, size and shape of each, and form of pulp chambers and root canals.
4. Drawing of all teeth, illustrating the cusps, ridges, fossae, roots, pulp chambers and root canals.
5. Reproduction in brass of typical

instruments included in Black's university cutting set.

The hours consumed in the course outlined above for freshmen are approximately 144.

SOPHOMORE

For the beginning of sophomore technic work, we first require each student to open about fifteen root canals. The technic used is known as the Callahan-Johnston method. The student is taught the correct procedure in opening the pulp chamber and exposing the orifices of the pulp canal, being careful not to destroy any more tooth structure than is absolutely necessary and at the same time being able to give proper access to the orifices of the canal.

He then uses a 40 per cent sulphuric acid solution, pumping it directly into the canals, and using Kerr's files, being careful not to open the canals by force, but more or less by persuasion and the proper manipulation of the file. The acid acts as a softening agent, aiding and assisting the file in its proper direction and at the same time enlarging the canal so that it can be more easily freed.

After the acid is carried down the canal as far as possible, it is neutralized with a saturated solution of sodium bicarbonate. This procedure is repeated over and over until the file will pass through the apical foramen.

When the technic of opening the canals is completed, we are then ready to proceed with the root canal filling.

Alcohol, pure or as nearly so as possible, is flooded into the pulp chamber and pumped down in the canal with the same kind of file that is used in opening, the operator being as certain as is possible that the alcohol has been carried down to the opening of the foramen. At the same time, it penetrates the dentinal tubuli and accessory foramina, which have been cleared by the action of the acid and soda. It is has been proved that the chlororesin solution, which is to follow, will readily displace and flow wherever the alcohol has penetrated. After flooding the canal with alcohol, this is then dried out with cotton points and dehydrated with a blast of air. We follow this by a solution of chlororesin, which is made by dissolving a few lumps of pure resin in chloroform until a straw-colored liquid is produced. This liquid is then carried into the canals by use of a small dropper, flooding the pulp chamber and carrying it down into the canal with the file.

We are now ready to use guttapercha points, which can be bought already made up in assorted sizes with flat ends so that they can be handled with cotton pliers. Having thoroughly filled the canals with the solution, we then introduce the guttapercha points directly into the canal, using a pumping motion and dissolving the points in the solution, thereby sealing the apical foramen.

When this procedure has been completed, each student is taught the correct method of preparing cavities, as indicated by G. V. Black.

Next, the student is thoroughly instructed in the manipulation, preparation and insertion of all fillings; namely, plastics, gold foil, cast gold inlays, cast hood abutments, and cast attachments for crown and bridge work. In addition, each student is taught the physical and chemical properties of each material, also the different changes that take place during the preparation and subsequently under the varying conditions of the mouth.

This course is designed to equip each student thoroughly to proceed to practical work in the dental infirmary in the junior year.

The following are the requirements in cavity preparation for the year:

Upper central incisor, left (Class 4), mesio-incisal cavity; gold foil filling.

Upper left lateral incisor (Class 3), mesial cavity; gold foil.

Upper left cuspid, hood, waxed, using three pins.

Upper left bicuspid, ¾ hood, cast, either copper or gold.

Upper left second bicuspid, mesioclusodistal cusp capped, to be waxed.

Upper left first molar, mesioclusodistal preparation, alloy filling.

Upper left second molar, mesioclusal preparation.

Lower left central incisor (Class 3), mesial cavity; silicate filling.

Lower left lateral incisor (Class 3), mesial cavity; silicate filling.

Lower left cuspid cast hood, pins and grooved to be waxed.

Lower left first bicuspid.

Lower left second bicuspid (Class 2), mesioclusal gold foil filling.

Lower left first molar, mesioclusodistal; alloy filling.

Lower left second molar, mesioclusal; alloy filling.

Upper right central incisor, hood, three pins, two steps.

Upper right lateral incisor, mesio-incisal (Class 4); cast inlay with silicate.

Upper right cuspid (Class 3), mesial surface; gold foil filling.

Upper right bicuspid, mesioclusodistal; inlay preparation.

Upper right second bicuspid, mesioclusodistal; cusp capped and waxed.

Upper right first molar, mesioclusodistal; waxed on buccal side, gingival, 1/3 (Class 5) smooth surface cavity.

Upper right second molar (Classes 2 & 1), on buccal mesioclusodistal.

The hours consumed in the course outlined above for sophomores approximate ninety-six.

JUNIOR

The early lectures to the juniors are planned to correlate their practical work, with which they are now having their first contact in the dental infirmary.

It is stressed that the impression made on the patient in the infirmary is a forerunner of the impression that the student will make on the patient in his later practice. One important thing for him to remember is that he is not working with saws, hammers and wrenches, but with delicate instruments properly designed, convenient to handle and to be manipulated with ease.

The way in which he conducts himself has altogether to do with the type of patient he will attract. In the very beginning, it is essential that he be immaculate in dress and person, particularly as to the care and appearance of the hands.

Each operator in the clinic will have a sufficient number of towels; one for his hands, one as a bib for the patient, one for the headrest and one for the operating bracket.

Certain items are necessary to be kept on the operating bracket, such as mouth mirror, explorer, cotton pliers, cotton, cotton waste holder, chip blower and dental floss.

He is told that all instruments must be assigned to a definite place in a particular drawer of the operating case. These instruments are to be kept in such order as to enable him to locate them rapidly in the light or in the dark.

The importance of the operating chair being at a correct angle and height for operations on the upper and the lower teeth is mentioned, as it is essential that the position of the chair and of the operator be made such that it will not be tiring to either the patient

or the operator. To further accomplish this, he is made familiar with, and it is recommended that he practice, the four principal positions at the chair; right side in front, right side behind, left side in front and left side behind.

He is given practical demonstrations in the application of the rubber dam, and is taught carefully how to place the dam in any position in the mouth and how to remove it when the operation is completed.

Comprehensive lectures are given the junior class on the histologic structure of the enamel and the pathology of caries of the teeth, and the mechanics taught in the sophomore class are reviewed. He then has the three fundamentals for intelligent preparation of a cavity.

Knowing the structure of the enamel, he understands in what direction it may be cut, or rather cleaved, with the least resistance.

Knowing the pathology of caries, he knows how far to make the extension for prevention. It is essential that each student know how to grasp his instruments to get a maximum of power, speed and accuracy. Therefore, the students are acquainted with and made to practice the various instrument grasps as outlined by G. V. Black; namely, the pen grasp, inverted pen, palm and thumb, modified palm and thumb, and the palm thrust grasp.

It is also important that each student know his dental anatomy.

All cavities are classified according to groups and classes, there being two general groups and five classes. The student is then ready for a definite procedure. In cavity preparation, he is taught the seven definite steps of procedure: (1) outline form; (2) resistance form; (3) retention form; (4) convenience form (apply rubber dam); (5) removal of remaining decay; (6) smoothing cavity walls and beveling cavosurface angles; (7) toilet of cavity.

The lectures for the junior and senior classes, which succeed these, are in gradation, and cover the subjects as outlined in any well-prepared textbook on the subject. Sixty-four hours each for juniors and seniors are devoted to these lectures.

THE INFIRMARY

The infirmary of a dental college is the proving ground of practically all that is taught in the preceding years of operative technic. It is also the finishing school of the embryonic dentist, preparing him to pass the requisite board examinations and to conduct a practice successfully.

In order to coordinate properly what has been taught in the preceding years of technic work with the student's practical work as carried out in the infirmary, it is necessary that, from time to time, conferences be held between the staff of the infirmary and those conducting the preceding instruction. At the same time, the professor of operative dentistry should be in attendance. Should there be any differences in theory or practice between the various men conducting any of these departments, they should at least agree on a common ground from which to address the student. This will avoid confusion; for the student will all too soon be confronted with various practices and theories, and will have to make up his mind which to adopt. From a pedagogic standpoint it is best to adhere to tried and tested fundamentals. We should not be "the first by whom the new is tried, nor yet the last to lay the

old aside." We should not teach dental "stunts."

There are about 1,200 hours available for infirmary practice in the combined junior and senior schedules. No one would say that a finished dentist can be trained in so short a time. We can hope only to complete his fundamental training, leaving it to him to work out his own salvation. We must do our best to see that he has had a well-rounded training in all the various features of operative work. In my opinion, the point system has proved the best basis of credit for work completed.

In the junior year, the points required may average about one-third the amount necessary for graduation, and particular stress should be laid on elementary work, such as prophylaxis and the use of amalgams and cements. These are considered to be more easily taught and are in line with the preliminary technics course. Later in the session, when the student has begun to grasp the principles of practical cavity preparation, he must take on work involving more exacting technic, such as the use of silicates, inlays and foil. A great deal along this line is not expected nor required of the junior student, but only so much as will thoroughly ground him in principles so that he may be ready for his senior year.

The junior student's first contact with the infirmary instructors is made when he checks in his instruments. Of course, a great many of the instruments are those he has had in his preceding technic years, but to these are added all the others necessary for the conduct of his infirmary practice. It is advisable to check completely each man's equipment, from the standpoint both of the school and of the student; from the school's because it should be standard and complete, and from the student's because there are so many unfamiliar instruments.

At this time the student is made to put into practice his didactic instruction as to the arrangement of all of these new instruments in his operating cabinet, and also how to keep them clean and in good working order.

In assigning the first patient to a a junior student, care should be exercised to see that there is no difficult work to be done and that the patient is one easy to control.

The student is first instructed to meet his patients promptly, seating them after adjusting the chair according to the principles that he previously has been taught. He then makes a thorough examination of the mouth, making his notations on the examination blank which is on the printed form of the assignment slip. When this is completed, he is to call an instructor who will go over the examination carefully with him and outline the work to be done.

It is essential that a student be taught to make his own examinations and record them. There is a vast difference to the student in being assigned to perform a certain dental operation (as is done in some schools) and in being allowed an opportunity to exercise some judgment in connection with his work; first, as to whether or not it should be done at all, and, secondly, as to the nature of the treatment or repair. Time may be saved by the first method; but a better dentist will be made by the second, which tends to develop self-reliance from the start.

In practically all cases coming to the infirmary for examination or work, prophylaxis is required. This is usually

the first work undertaken by a junior student, not because it is simple but rather because of its comprehensiveness. Right here is an opportunity to impress the student with the fact that all dental work must be thorough and painstaking in every detail, if he is to become a successful dentist. It may take him one hour or more to complete the case, or it may take several sittings. In either instance, it is important that the student make his first prophylactic treatment most complete, to serve as an everlasting impression on his mind and as an example of all subsequent work.

We come now to fillings. We shall consider that an examination has been made and approved by an instructor. Before the cavity preparation is started, the tooth must be examined by an instructor and an outline given to the student. When the cavity preparation has been completed and the rubber dam is in place, he is ready to call an instructor, who will also indicate the filling material to be used. In case amalgam has been used, the student must have the filling approved after it has been inserted, and, at a subsequent sitting, the student polishes the filling, calls an instructor, and, if the work has been done properly, he will at that time receive credit for the work.

We see from this how intimate is a student's contact with the instructor. In the case of an amalgam filling just outlined, the instructor must see the tooth at least four times: (1) before anything is done; (2) when the cavity is completed; (3) after the filling is inserted, and (4) after the filling has been polished. This rule applies to all restorations. Before an inlay is cemented in place, it must be inspected by an instructor, who will, at that time, make sure that the occlusal carvings are correct, that it has the proper contour of the interproximal spaces and that the contact point has been restored. If these are approved and the filling has been thoroughly polished, it is then ready to set, after which the points may be awarded.

It is the best that one instructor see a case from start to completion. In order that this may be done successfully, the infirmary should be divided into sections, with one instructor in charge of each section, and the student should be required to work in that section all the time. Better still, a student should be assigned to one particular chair and do all of his work there. By rotating the instructors from one section to another, the student is given the benefit of the various instructors' abilities, thereby broadening his vision and becoming a better dentist.

Although a student has had, in his first two years, a comprehensive training in technic, enabling him to carry on cavity preparation in the infirmary, there is still a tremendous difference between preparing cavities in bone teeth and preparing them in teeth in which there is a vital part. Care must be exercised not to ignore what has been taught him previously, but to coordinate his teachings earnestly and show him that outline form, for instance, is in reality the first step in cavity preparation. It is a difficult matter to induce a student to visualize the various steps of cavity preparation in their proper order; but one method that will assist him in so doing consists in having him lay out on the bracket the instruments that probably will be necessary for use in a particular cavity. All of these are outlined in Dr. Black's book on operative dentistry, and

the student has been taught them. When these instruments are laid out in their proper order, the student, in his mind, will question what each is for, and so will coordinate his former instructions with the procedure necessary for the case in hand. In this way, we shall, to some extent, avoid the embarrassing occurrence of a student taking a large bur and going straight down into the tooth, looking for firm tooth structure at the base of the cavity and (forgetting all about the proper outline the cavity should have, the unsupported enamel, etc.) finding, instead, the pulp.

Another plan to stimulate proper cavity preparation is to have on display, in a prominent place in the infirmary, models showing the different classes of cavities in their ideal form. It is best to have these models very large, say, ten or fifteen diameters, and have the direction of the enamel rods sketched on the cavity wall; also to have the dentin colored a light yellow, so as to show the dento-enamel junction. Supplementing these, there should be on display the progressive steps in the insertion of foil fillings in both anterior and posterior teeth.

Still another plan which should be made fundamental to our infirmary practice is that of prohibiting students from beginning operations of any kind without being thoroughly familiar with what they are undertaking to do. They should be made to stop right where they are, dismiss the patient, go to the library and "read up" on exactly what line of procedure to adopt, thus being prepared for the patient at the next sitting. This is particularly advisable in root canal work.

In root canal work, the student must call an instructor at the following times: (1) before beginning the operation; (2) after the canals have been opened and the diagnostic wires are in place (at which time a checkup radiogram is made); (3) when the root canal filling has been completed, (at which time another checkup radiogram is made). After the completion of these steps, the student is awarded his points. These represent the minimum number of radiograms.

The senior year of infirmary practice is a continuation and enlargement of the experience the student has had in his junior year, and, as a general rule, the points are cumulative. It may be that, in his junior year, a student has had an opportunity to do quite a little work of one particular kind, such as, say, in amalgams or inlays, and has not been able to complete the minimum requirements of all the different varieties of fillings. This does not excuse him from the necessity of completing this other work; but he may be given credit for this surplus of junior work on his senior year requirements.

In order to certify to a senior student's progress properly, it is necessary, from time to time, say, every month, for the instructors to meet and confer on the status of each member of the senior class. In this way, we are able to determine who are the slow ones and those behind with their work. These should be interviewed by the superintendent of the dental infirmary, or the dean, who will warn or encourage each student so interviewed.

Another requirement, in addition to points, that yields good results consists in having each senior student prepare, without any advice or assistance from the instructors, a cavity for a foil filling, an amalgam filling and an inlay.

This work should receive the inspection of the heads of the departments, and will stimulate the student to do his very best work. In addition, it will give him confidence in himself, because he has to do all the work unassisted.

CONCLUSION

Since it is almost impossible to predict what work a junior or senior student will find to be done next in a patient's mouth, the only plan to follow is to be thorough in the requirements, from the beginning. Be ready to help him whenever necessary; but be very careful not to do more work than is necessary to assist him over his present difficulty. Too much help may prove a mistaken kindness. We must remember that no matter what the minimum point requirement may be, the student will always have much to learn which only experience can teach. We should try continually to impress this on our senior students, encouraging and requiring them to do all the work they possibly can, striving always to make their work show improvement.

106 Forrest Avenue.

DISCUSSION

Harry M. Semans, Columbus, Ohio: Dr. Byrnes has presented in a clear way what has become quite standardized in methods of teaching operative dentistry. Happily, this standardization has not been brought about by forced and rigid rules, but has maintained aspects of differences which one can readily see in this paper just presented. In other words, the teaching of operative dentistry in its standardization presents rather a strong substantial skeletal structure on which an individualistic character is built. This latter aspect allows methods of both technical and clinical training to be somewhat different in the various colleges of dentistry. And I take it from Dr. Byrnes' paper that, while he has outlined quite thoroughly the methods adopted at Atlanta, he is not arbitrary about it. Instances of difference can be shown, in that drawing and sketching of teeth with his department follows modeling, whereas at Ohio State University, drawing and sketching precede modeling. Our modeling in compound differs in that we use soap and plaster. We, as they, require reproductions of the teeth in bone or composition, into which we require our sophomores to carve cavities as do they. To differ is human and lends to a happy interchange of ideas and individualistic endeavor to improve good procedures and cull out the poor and pare down the doubtful ones. We all have the one big idea in our teaching: "Instruction . . . is of inestimable value in training the eye to the observance of the minutiae of detail and in developing in the fingers the delicacies of touch." Again, the practical methods of training in the infirmary show standardization. The very inception of our present association of dental teachers, thirty-two years ago, featured almost entirely operative technical procedures and has maintained throughout the years since a constant interest of large aspect. Yet individualistic methods are found in each college, adaptations of convenience to local usages and demands. This is as it should be, and does not necessarily enhance or lower one school. Probably, the most important thing in clinical training is self-assurance on the part of the student, a very necessary condition, before graduation is granted. This situation or condition of mind must be carefully checked by the staff; also, self-assurance must carry with it knowledge of how and why to do things for the patients. Dr. Byrnes has clearly presented these necessary conditions in training. I desire to emphasize one of his statements. "One instructor should see a case from start to completion." This method, he explains, can avoid the disadvantage of monotony and the, perhaps, narrowness of the individual instructor by an arrangement for rotation of instructors. To quote again a very important statement: "Be ready to help him whenever necessary; but be very careful not to do more work than is necessary to assist him over his present difficulty. Too much help may prove mistaken kindness."

A. C. LaTouche, Los Angeles, Calif.: Dr. Byrnes has portrayed a logical sequence of exercises, didactic and technical, which should provide a foundation upon which a superstructure in operative proficiency may well

be erected, meeting all the requirements of that comprised within the scope of operative dentistry; first, introducing the student to the terminology of the calling he has elected through drilling in nomenclature; then, familiarizing him with the parts on which he is to operate by modeling, carving, drawing and the study of charts; then, opening into pulp canals, making sections and finally a minute study of tooth structure; all providing an intimate knowledge of that we term, "dental anatomy," which is so very essential in all phases of operative procedures, cavity preparation, root canal work, restoration, construction, etc. Paralleling this with a study of instrument construction and form, which provides an appreciation of precision and develops dexterity and acquaints him with the means to the end in cavity preparation. A close study of cavity preparation, and filling materials and their manipulation, is provided in the second year in the technic course when the bone carvings of the dental anatomy course are made use of. This constitutes an essential preparation to that which Dr. Byrnes terms the "proving ground," or operative clinic. Here, we are most heartily in accord with Dr. Byrnes as to a standardization of teaching and procedures; a close supervision by the head of the department and strict coordination of all units; adhering to fundamentals and the avoidance of all "stunts." In the clinic, the effectiveness of previous teaching in technic may be destroyed if unity of methods is not preserved. The clinic should depict the practical application of that which has preceded it as "operative technic;" that is, there should be no possible differentiation of the theoretical from the practical.

RESIDUAL FOOD ODORS OF THE MOUTH*

By HARVEY STALLARD, Ph.D., D.D.S., San Diego, California

THE mouth has more intimate contact with fresh food than has any other part of the alimentary tract. One would, therefore, suppose that breath odors from ingested foods would be attributed more to odoriferous essences remaining in the mouth than to the presence of the semi-digested food in the stomach or in any other part of the digestive tube; yet onion and garlic eaters will often attribute the long retention of such odors to the condition of their stomachs or sometimes the colons, and will even take enemas or purgatives to expel these substances and rid themselves of the odors. Foul breath may be due to all sorts of body disorders, but this paper proposes to deal only with breaths possessing fresh food odors, not those contaminated with gases and liquids from abscesses, retention of putrefied food or diseases of the respiratory organs and passages; in short, those unsocial breaths so well known today as halitosis.

Some lay people, in explaining the long duration of food odors on the breath, speak as if they believed that the expired air had passed over or through the contents of the stomach. Others have asserted that such odors come principally from the lungs. The food essences, having been digested and absorbed by the blood, would be, they believe, excreted along with the carbon dioxid in the expired air. It has also been supposed that the salivary glands excreted the onion and garlic oils into

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the mouth and thus prolonged the breath odors as long as the parent foods remained in the digestive tube. Dentists are wont to believe that food odors cling to the teeth or the interproximal tissues and that an edentulous person should be freer from food odors than one having teeth.

ONION ODORS

I have endeavored to discover what retains food odors, whether they are held by oral organs or excreted into the mouth. Pharmacologists have worked along this line, particularly with garlic, long said to be discernible in the breath and sweat of a subject who has taken it per rectum or via the skin. The same sort of experiments have been made by them with more specific flavorings and even simpler drugs or elements.

By having subjects chew onions without swallowing any, it has been found that onion odor can be detected on the breath for from twelve to sixteen hours. By experimentation, it was found that when an edentulous person chewed macerated onions without swallowing any, the odor, though less pronounced, was noticeable almost as long as in a person having teeth. Further, when persons, dentulous or edentulous, swallowed either macerated or unground onions in double gelatin capsules without contaminating the oral mucosa, teeth, or pharynx, the onion breath odor was completely avoided except in belching, which always follows the swallowing of capsules, since considerable air is always unavoidably enclosed in them. The gases arising from the stomach, although laden with the odor, do not contaminate the mouth. Introduction into the alimentary tract through capsules per rectum also gave negative results.

By wiping onion juice absorbed in cotton, or directly from freshly cut pieces, on the teeth, tongue, palate and cheeks in different experiments, it was found that teeth will retain the odors for not more than an hour, provided the mucosa of the interproximal gingiva is not contaminated and the teeth are allowed to dry before they are rubbed with the tongue and cheeks. The mucosa of the cheeks and lips retain the odor longer than do the teeth, but not so long as the palate and the *dorsum linguae*. The tongue, being rougher than other parts of the mouth, has a greater surface for absorption. In preparing onions for these various experiments, I found that onion oil will cling to the epidermis of the hands and be detected thirty-six or more hours after application, in spite of the usual or more frequent washing with soap and water.

To show the possibility of the mouth's being contaminated by air charged with onion odor, a subject was permitted to suck air through macerated onions for an hour, and it was found that the breath odor so obtained and transmitted was mild and of short duration.

The reason dentulous persons retain onion oil in the mouth slightly longer than the edentulous is probably that the tongue is more intimately and thoroughly contaminated, since chewing causes much squirting of the essences on the tongue, which has such close relations with food during chewing and swallowing. This conjecture is supported by the fact that onions finely macerated in a mortar contaminate the

skin of the hands more than do cut or chopped onions.

GARLIC ODOR

The foregoing experiments were repeated with garlic, and it was found that the garlic odor remains in the mouth for seventy-two or more hours after being eaten raw and swallowed. The breath odor for the first twenty-four hours is strongest, after which it becomes slightly more musty. When macerated garlic is chewed and not swallowed, the odor remains in the mouth breath for only from sixteen to twenty hours. Its oils are more easily washed from the hands by soap and water than are those of onions. When garlic is taken per rectum or swallowed in capsules, a mild musty garlic odor is discernible on the breath for from forty-eight to sixty hours. Garlic poultices cause violent skin blisters, but not enough oil is absorbed to be discerned in the breath. These experiments substantiate former claims that garlic odors appear in the breath and sweat when taken into the alimentary tract in any manner. It is impossible to account for the garlic breath by asserting that its gases arise from the stomach. I have been unable to determine whether the prolonged musty odor arises from the expired pulmonary air or from the salivary or mucous excretions in the mouth.

BOWEL ACTIVITY

Taking enemas and purgatives does not seem to hasten the disappearance of these odors. The two subjects on whom most of these observations were made had bowel evacuations every day, and the one retaining the odor the longer had an evacuation twice or three times daily.

OTHER FOODS AND SMOKE

It is well known that frying or boiling onion and garlic bulbs destroys their oils, and, hence, when cooked, these foods do not so thoroughly contaminate the mucosa of the tongue and mouth cavity as when raw. These foods, having the most powerful odors, so clearly discernible and so easy differentiated from disagreeable halitosis, are well suited for such experiments. Such foods as cabbage, celery, oranges and bananas have mild odors and can scent the breath for only a short time, an hour or more. Coffee can be detected from one to two hours after being drunk. Time has not permitted any investigation of breath odors from other beverages.

Smokers who do not inhale or otherwise contaminate the nasal linings will retain tobacco odor in the mouth from ten to sixteen hours. In smoking, the tongue also seems to be more loaded with odor than are the lips and cheeks. The finger of a cigaret smoker will retain the odor of smoke about the some length of time as does the tongue, provided the short stubs are held between the fingers, not in a holder.

REMOVAL OF FOOD ODORS

Of lemon juice, chlorin preparations and alcohol, used to destroy onion and garlic odors, it was found that chlorin is most effective, although onion and garlic oils are both soluble in alcohol. It has been impossible with either alcoholic or chlorin preparations to remove all the odor in either dentulous or edentulous persons.

247 Spreckels Building.

DISCUSSION

Henry C. Ferris, New York City: I agree with Dr. Stallard's findings, with reservation. My research in this field has been directed on a different theorem. My effort has been to establish a normal, and from that to study the pathologic fetor of the breath in disease. That the intake of food contaminates the odor of the breath must be acknowledged; but it does not follow that the residual odor, incident to the food intake, resembles the original odor of the food, nor does it represent the basic odor, as I shall endeavor to explain. Expired air consists mainly of nitrogen, oxygen and carbon dioxid. The proportion of the latter is less than that present in atmosphere, consisting of 4.78 per cent by volume of carbonic acid, aqueous vapor of ammonia and organic impurities. External cold increases the intake of oxygen, and the discharge of carbon dioxid; while a rise of external temperature is followed by a diminution of both. Muscular exercise acts in the same manner as cold air. Food produces the same result; while fasting lowers the intake. In the case of "Ceth," the fasting man, the absorption of oxygen and the discharge of carbon dioxid per kilogram of body weight fell rapidly. Previous to fasting, it was 0.73, and on the third day, it was 0.65. Vegetable food raises the respiratory quota to nearly unity of the gases; while a flesh diet is about 0.72, and the mixed diet somewhat higher. Among the curiosities in the literature, there are reported cases of luminous or bright red breath, and others of inflammable breath in which there was a flash from the holding of a lighted match near the mouth. In health, the breath is nearly odorless, inseparable from a sweet odor from mucous glands at the mucocutaneous junction in the anterior nares in both sexes. Some authorities state that those not in good health possess slightly disagreeable nasal odors. The sweet odor referred to has been stated to be absent or replaced by a disagreeable odor in pregnant women. In women, the expired air frequently acquires a disagreeable character during the menstrual period, said to be due to the nasal or retronasal secretion of the mucous membrane, which at that time is congested, with resultant dryness of the anterior nasal cavity. Each person is characterized by a particular odor. The higher the individual is in the scale of civilization, the more delicate the odor. The colored race emits a musty odor. This is probably due to the formation of combustible hydrogen from chemical decomposition of the breath, which is particularly pungent to the olfactory nerves of the white race. In my studies of pathology, I first investigated the sediment of the saliva, which is an extraneous matter, and is the detritus of the oral cavity. In order to eliminate contaminating odors, I centrifugalize or filter the specimen, and examine the filtrate for its odor. This method is more positive and less confusing to the sense of smell, and represents the constitutional states rather than the temporary condition of the oral secretions. In studying body states, we are principally interested in the odor of the filtrate which is dialyzed through the salivary glands from the blood stream. In general, the sediment should not be regarded as part of the saliva in determining the odor. Apparently, few investigators have carried out this procedure, or else they have failed to record their technic. The sediment contains devitalized epithelial tissue, food débris, products of putrefaction and fermentation of proteins and carbohydrates, as well as numerous microorganisms which give saliva its characteristic turbidity; and its appearance is a compact grayish mass—*materia alba.* Sometimes, it is brown, yellow or red. All these changes are noted, and are of diagnostic importance. The reaction of the whole and supernatal saliva is often slightly different; enough to make the secretion acid in one instance, and alkaline in the other. William J. Gies noted that the whole saliva is more alkaline than filtered or centrifugalized saliva, and that the sediment is highly acidic. He attributed the acidity of the sediment to the decomposition of the mucinates, which he designates as acid mucinates. It can be readily seen that these conditions would result in modifying the odor of the breath and should be eliminated if we are in search of the residual odor, the product of digestion and metabolism. Proceeding on this technic, we find that in uremia, the breath acquires a strong ammonia odor. This is due to non-elimination of the urea from the urine, which persists in the blood and combines with water to form carbonate of ammonia, which is split from the urea of the saliva. The skin also exhales the same odor. In diabetes, the breath has a sweetish odor difficult to describe, and some-

times likened to the odor of honey, sweet apples or hay. Various mineral substances which are introduced into the system and are odorless produce a disagreeable odor of the breath during certain periods. It occurs in stomatitis, and in other diseases arising from disturbances of digestion induced by chronic poisoning. Substances most frequently concerned in production of toxic halitosis are: antimony, arsenic, lead, mercury, phosphorus and sulphur. After two hours, sulphur imparts a distinct odor to breath and perspiration. In cases of extensive burns in which the breath was formerly sweet, a disgusting odor of bisulphid of carbon may be present, in migraine accompanied by bad breath. In fevers, the breath acquires a sweetish or sometimes sickening character, particularly noticeable in children. In chronic alcoholism, the expired breath and the saliva are foul, not necessarily alcoholic, but possessing a peculiar odor. I have found that in all cases of obstruction of the alimentary canal, from whatever cause, sour secretions and breath are common. In nephritis, it is still more marked. In epilepsy, it becomes more noxious, and in dementia the odor is intolerable. In the majority of cases, my patients have been unaware of any disagreeable or noxious odor in the breath until attention was called to it. In necrotic states in the buccal cavity, odors are produced by the effect of bacteriologic development on the mucosa; and a diagnosis through the sense of smell comes in the everyday practice of experienced diagnosticians. I lost a son, 5 years of age, who was treated for follicular tonsillitis for a week, in a country district, by a New York college professor of bacteriology. At the end of six days' illness, the patient failed to improve. A local physician was called in, and from the patient's foul breath, he diagnosed the case as diphtheria as soon as he entered the door. The bacteriologic investigation after death, at the Hoagland Laboratory, proved it to be diphtheria. Had the first physician who was called been familiar with the odors of the toxins of the bacilli of diphtheria, antitoxin could have been administered, and would probably have saved my son. The dentist in his daily practice can make differential diagnoses between caries, putrescent pulps or periodontoclasia from the fetor of the breath; and in rare cases, carcinoma of the tongue and tuberculous ulcer or necrosis of the soft tissue, as in noma. The odor of the breath is a combination of several odors, but the residual mouth odors are most accurately distinguished from the filtered saliva. This we must acknowledge, and any technic which simplifies the recognition of residual odors is worthy of consideration. The education of the olfactory sensations can be developed only by constant observation; and the practitioner who has developed a differential sense of smell has broadened his diagnostic ability.

OSTEITIS OF THE MAXILLA AND MANDIBLE: ETIOLOGY, DIAGNOSIS AND TREATMENT OF ACUTE AND CHRONIC STAGES*

By HAROLD S. VAUGHAN, M.D., D.D.S., F.A.C.S., New York City

THE etiology of osteitis of the maxilla and mandible may be divided into predisposing causes that serve to lower the general and local resistance of the patient, such as exposure, measles, scarlet fever, diphtheria, anemia, leukemia, syphilis, tuberculosis and typhoid; trauma, such as from fractures or tooth extraction, and chemical agents, such as arsenic, mercury and phosphorus. The chief exciting cause is invasion of the bone by pyogenic bacteria, in most cases through the apex of a pulpless tooth, and often the immediate result of dental treatment in an attempt to open a pulpless tooth.

I have seen two severe cases that developed from a furuncle on the chin, the organism being a virulent *Staphylococcus albus*. Other cases develop from bacterial emboli in connection with osteomyelitis of the long bones.

*The papers of Drs. Vaughan, Federspiel and Miner were presented as a symposium.

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

DIAGNOSIS

It is at times difficult to differentiate at first between an ordinary dentoalveolar abscess without destruction of bone and an osteitis with mass destruction; but, in the former, there is a tendency to limitation of the area of swelling, with a breaking down and pointing of pus through a limited subperiosteal abscess, which can be readily excised; while, in an osteitis with bone destruction, the swelling is less marked over a local area in the beginning, with a tendency to spread over a large area without localized pointing of pus. Probably, the first indication of a destructive osteitis is the loosening of teeth over the inflamed area.

The temperature is higher, the patient complains of more intense pulsating pain, there is greater prostration and the leukocyte count is higher.

Roentgen-ray examination does not show the extent of involvement at first, but the appearance is typical after a breaking down has taken place within the bone.

Osteitis of the maxilla and mandible, frequently the severest type of infection

encountered about the face, often requires the exercise of greater judgment than any other infection in determining when and how far to interfere surgically.

The bacterial invasion may be from the apex of a pulpless tooth. It then spreads through the cancellous bone, and along the inferior dental canal in the mandible. The inflammatory process may be so overwhelming that the haversian canals and nutrient foramina in the bone are soon plugged by bacterial thrombi and broken down tissue cells, which shut off the circulation and produce death of the adjacent bone *en masse*. The process may then extend through the dense cortical bone and reach the periosteum, which is soon stripped off by the suppurative process, loss of circulation resulting within this entire area.

This is followed by an invasion of the soft tissues and a cellulitis, with marked edema and swelling. There are variations between the maxilla and mandible, dependent on the structure of bone in the mandible, especially in the posterior portion and ascending ramus, where the bone is denser. There is, therefore, more mass destruction; the period of exfoliation is longer, and, in some cases, a sinus will persist, down to an area of bare bone which shows little or no tendency to clear up until the aroded surface has been well curetted.

In the anterior and middle portions of the mandible where there is more cancellous bone, the process of exfoliation is much more rapid.

In the maxilla, with less cancellous bone, and where the infective process soon becomes subperiosteal, we rarely find such mass destruction of bone. It is usually confined to definite areas except in the fulminating type, in which the entire half of the maxilla is likely to be permeated with areas of softening and breaking down, the suppurative process often extending to the palate bone and vomer, into the nose, accompanied by loosening of all the teeth on the infected side, but rarely across the median line. These cases are associated with grave general symptoms, high temperature, rapid pulse, high leukocyte count, marked edema and swelling of the adjacent soft tissues, lymph node involvement and severe prostration. Rapid and extensive surgical interference is demanded in order to stay the progress.

The fulminating type is more often associated with infection from the root apices of the incisors, the lateral incisor being the starting point far more often than the central incisor. Fortunately, the larger percentage of acute inflammations of the maxillary and mandibular bones go on to resolution or suppuration without damage to their structural integrity.

The chronic types of osteitis of the maxilla are those associated with tuberculosis, syphilis and arsenic poisoning, and also the occasional localized osteitis and necrosis following infection in a nongranulating or dry socket. Tuberculous osteitis of the maxilla and mandible is occasionally met with as an extension of a tuberculous ulceration. I have seen five cases in private practice and several in hospital service. The best results have been obtained by com-

plete excision of the involved area followed by appropriate general treatment.

Syphilitic osteitis of the maxilla was formerly more common but seems to be less prevalent in recent years owing to improved methods of treatment. The palate portion of the bone is more frequently attacked in connection with the vomer and internal antral wall. The local treatment indications call for drainage and dressings until the sequestra exfoliate; while general antisyphilitic treatment should be pushed.

Arsenical osteitis of the maxilla and mandible, due to the escape of arsenic when sealed into a tooth for pulp devitalization, is now rarely seen, though formerly such cases were common and often resulted in the loss of several teeth.

Phosphorous osteitis and necrosis was formerly quite prevalent among workers in the match industry. It usually involved the mandible and resulted fatally in a large percentage of cases, though the danger has been eliminated by proper protection for the workers. I have more recently seen three cases of the same general character among workers in watch factories, in connection with the making of illuminated dials, the small brush used in lettering being turned between the lips to give it a point. Two of these cases had a fatal termination.

Posttyphoid osteitis and periosteitis usually involves the mandible in the form of a circumscribed area within the bone, which may later break through under the periosteum, necessitating curettment and drainage.

Osteitis deformans, occasionally met with in the maxilla and mandible, is characterized by an extreme enlargement and progressive deformity. The bone becomes decalcified and softened and the teeth loosen. Operative interference is sometimes necessary in order that a denture can be worn.

The soft tissues are reflected and the enlarged and softened bone can then be cut away with a knife to the required contour.

TREATMENT OF ACUTE OSTEITIS OF THE MAXILLA

If the osteitis is of the milder or more circumscribed type, the area should be opened freely, down to and into the bone; the involved tooth or teeth should be removed, and the surrounding eroded bone should be removed by rongeur and curet, after which iodoform gauze dressings should be applied. Prompt treatment in this manner will usually result in checking the spread of infection, the severe symptoms will soon subside.

FULMINATING TYPE OF ACUTE SUPPURATIVE OSTEITIS OF THE MAXILLA

The fulminating type is accompanied by profound general symptoms with a tendency to extend rapidly through adjacent tissues and call for prompt and complete surgical interference. These cases demand a different type of operative procedure from that employed in mandibular involvement. Under general anesthesia, all the teeth of the affected side should be removed. The soft tissues which are already separated from the bone should be retracted. The exposed bone is usually found to be permeated with multiple areas of sup-

puration. The diseased bone should be removed by rongeur and curet until the limit of the suppuration has been reached, and they may extend up to and into the antrum and along the palate process into the palate bone and at times along the side of the vomer. The diseased tissues should be followed up and removed until sound bone is reached. The wound is dressed with iodoform gauze and the soft tissues are loosely approximated by sutures.

The after-treatment should consist of free catharsis, application of icebags to the edematous areas, and employment of mouth washes, daily irrigation, and dressings, especially when the antrum is opened.

OSTEITIS OF THE MANDIBLE

Treatment of Acute and Chronic Stages.—Acute suppurative osteitis of the mandible, or osteomyelitis, as it is usually termed, because it takes the same clinical course as suppurative inflammation of the medullary canal in long bones, is characterized by an infection which spreads throughout the cancellous substance of the bone and along the inferior dental canal. In severe cases, the entire body of the bone and ascending rami are involved. In other cases, it may be limited to one side, or the milder cases may involve only one or two teeth, especially when the infection develops from a tooth socket, the so-called dry socket.

The treatment in the acute stage calls for the removal of loose teeth, with free opening into the cancellous bone and the free incision of all subperiosteal swellings. These areas within the mouth should be dressed with iodoform gauze in order to provide drainage and protection from mouth secretions. From a cosmetic standpoint, it is desirable to avoid external incisions as much as possible as they lead to unsightly depressed scars and an irregular contour of the regenerated bone. Icebags should be applied externally; cathartics should be given, and the patient must be kept up with nourishing liquid diet.

After the acute symptoms have subsided, and during the subacute and chronic stage, the exercise of care, skill, patience and judgment is necessary to maintain adequate drainage, for this is the stage of bone regeneration or formation of the involucrum which is to replace the sequestra. Meddlesome surgery, with removal of necrotic bone before sufficient regeneration has taken place, may lead to a pathologic fracture, with nonunion, a complication that never arises except through ill-advised attempts to hasten the removal of sequestra.

These severe cases may last from two or three months to a year, and the patient must be made to realize that time is required.

Frequent roentgen-ray examinations should be made during the progress of exfoliation so that surgical assistance can be rendered at the proper time. At a certain period in the breaking up of the bone, the appearance of the roentgen ray may suggest a fracture. I have seen many cases so diagnosed (by the radiologist or the inexperienced operator) at a time when the new bone, though amply strong for support, had not yet become sufficiently calcified to show in the roentgen ray.

OSTEITIS OF THE MANDIBLE AND MAXILLA: ETIOLOGIC FACTORS, DIAGNOSIS AND TREATMENT OF ACUTE AND CHRONIC STAGES*

By MICHAEL N. FEDERSPIEL, D.D.S., M.D., Milwaukee, Wisconsin

IN the study of inflammatory conditions of the jaw bones, it is necessary to keep in mind that the essential pathologic phenomena, hyperemia, exudation and tissue changes, active or passive, are similar to the same inflammatory conditions as manifested in any other vascular structure, except that the end results are modified by the small space occupied by the vessels and the resisting structure of the surrounding bone.

An acute inflammation with a rapid vascular engorgement and the outpouring of a large exudate may, by increase of pressure within the unyielding bony canal, cause a thrombosis, shutting off any further nutritive qualities of the free flowing blood, and resulting in the death of a circumscribed portion of bone, called necrosis. Of course, a similar process may occur after a metastatic, hematogenous infection.

If the inflammatory process is subacute, so that the tissue-liquefying properties of the exudation and the tissue-absorbing activity of the various cellular elements can be at work, there is developed an abnormal porosity of bone by the enlargement of its canals or the formation of abnormal spaces in which the inorganic matter is lessened, called caries.

If the inflammation is chronic, the persistent irritation is most likely to result in a condensation and may be considered as Nature's attempt to limit the spread of disease, and if it should terminate in a cure by natural means, the area involved becomes a bone scar, called osteosclerosis.

There seems to be, in the mind of many, a confusion regarding the terminology of inflammatory affections of the bone. When one fully understands that necrosis, caries and sclerosis are results of acute or chronic inflammations, and that the inflammation of the bone itself, of the compact part, is osteitis, there should be no misunderstanding of terminology and the term "osteitis" is rightly applied. When the medullary cavity of a long bone only is affected, the term "osteomyelitis" is substituted. This also applies to the cancellous structures in flat bones when affected by an inflammatory process.

The close vascular connection between the periosteum and the inner structures of the bone will explain why a periosteitis may be associated with osteitis, and why an osteomyelitis is never strictly limited to the medullary canal or spaces of the bone.

The complex anatomic structures of the jaws, teeth and adjacent structures are frequently subjected to inflammatory conditions. By the process of tooth decay and subsequent infection of the pulp, the frequent pathologic manifes-

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

tation of the investing tissues of the teeth, no doubt bacteria most commonly enter the bony structures *per continuitatem* to give rise to inflammation. Fortunately, the end results are usually of local character. The acute, painful pulpitis or pericementitis is limited in the process of gradual destruction of the tissues affected. The removal of a tooth to establish free drainage is generally sufficient to stop the advance of the local infection.

If a patient is in a state of depressed general health so that the germicidal powers (general and local resistance) are considerably diminished, the infection by way of the teeth may determine the commencement of a gradually increasing inflammatory process which will spread until a large part of the bone may be involved. In a jaw that is not sufficiently elongated backwards to allow the third molar to occupy its position in horizontal line with the other teeth, and consequently permits only a partial eruption to a position where the mucous membrane is reflected from the gums to the cheek and fauces, a very serious and alarming infection may develop.

The operculum of gum which covers part of the crown, allowing decomposition of the epithelial scales and débris of the mouth, combined with the power of the acids, engendered by their disintegration, to corrode the structure of the tooth, may involve the pulp and result in a violent pulpitis and subsequent infection of the jaw bone. Frequently, the infection may start at the gingiva and involve the pericemental membrane, leading to a gingivopericementitis. It is interesting to note that the infection from a partially unerupted third molar may develop either an osteomyelitis or an osteoperiosteitis of the surrounding bone.

A gangrenous pulp of an impacted third molar is the usual causal factor in a deep seated inflammation of the cancellous structure of the jaw (maxillary or mandibular osteomyelitis). Once this develops, the process is of an acute nature, with symptoms generally attributed to an acute osteomyelitis. If the infection should begin as a gingivitis, it may travel into and beneath the periosteum, with symptoms indicating an acute osteoperiosteitis.

Inflammation of the deeper structures of the jaw may frequently arise from a compound fracture, especially if the fracture involves a jaw that possesses a diseased condition of the teeth and investing tissues.

One of the most frequent causes of osteitis of the jaws is a careless and crude method of surgical procedures.

In this day of injudicious extraction of teeth, popularly called surgical removal, by operators who are not trained in surgical pathology and surgical principles and who have little or no surgical judgment, many patients have been subjected to the alarming and painful spread of jaw infections. Especially is this true in long and tedious operations for the removal of impacted teeth in which the infected wound is closed with soft tissues and sutured. Lack of good drainage permits the inflammatory process to extend to the adjoining tissues and small vessels, resulting in a very acute condition that may be extensive in spreading through a large part of the bone.

Usually, such conditions will create a dangerous complication when an osteomyelitic focus once starts on its terrible and destructive path through

the structures of the bone, continuing until it breaks through to invade the soft tissues. This is especially ominous if it involves the floor of the mouth. In the loose connective tissues which join the muscles that arise from the mandible, the purulent, serous infiltration proceeds into the pouch occupied by the submaxillary glands—shut off externally by strong fascia—and goes on to involve the soft parts in the depth of the neck or may even extend into the anterior mediastinum.

Naturally, this large swelling of the soft tissues will push the tongue and soft palate back against the posterior pharyngeal wall. Swallowing is then practically blocked, the patient cannot partake of nourishment and the saliva flows out of the corners of the mouth. If the inflammatory edema and infiltration continues to make its way under the floor of the mouth, it may gain entrance to the structures of the larynx (laryngeal perichondritis) and respiration is in danger because of gradual or sudden development of edema of the glottis.

Those of us who have seen patients with this type of infection will never forget the alarming clinical picture of a cellulitis involving the floor of the mouth, the submaxillary pouch and the loose tissues of the neck. The disease travels with extremely rapid progress and is one of the most dangerous of infections, called Ludwig's angina. Our surgical help is limited: we look on powerless.

The treatment is discouraging, especially if general septicemia has developed. When marked edema of the glottis is present, the disease usually has a fatal termination. However, even though one does not always succeed even by the most radical measures in stopping the rapid spread of the purulent inflammation and the general septicemia, the treatment necessitates opening wide the infected soft parts in the mouth and making deep, long incisions of the hard infiltrated tissues between the lower jaw and the hyoid bone in order to open the submaxillary pocket. Liquid pus is usually not found when the diseased area is opened, but sometimes a foul smelling fluid appears to ooze.

One should keep in mind that similar fulminating infections may result from the presence of any infected tooth. Once the focus breaks through the bony structure, and if it is still of a virulent nature, it will invade the adjoining soft structures. An inflammatory edematous swelling of the mucous membrane and the underlying tissues of the jaws, lips and cheeks follows, leading to a diffuse phlegmonous infiltration. If such a phlegmon involves the facial veins or the external jugular vein, a thrombophlebitis may occur, resulting in further complications.

About a year ago, a patient under my observation, a man, aged 48, had been suffering from an acute inflammatory process of the peridental membrane of a right maxillary first permanent molar. His dentist had injected a 2 per cent procain solution into the surrounding structures and extracted the tooth. The next day, a rapid spreading of the infection developed in the surrounding tissues. Forty-eight hours later, a retromaxillary phlegmon extended over the sphenopalatine fissure. Then the orbital area became involved and finally the infection sagged downward, terminating in a perimaxillary phlegmonous infiltration, with a marked trismus. Wide

incisions were quickly made, pus flowed freely and the wounds were kept open and drained. The patient failed to respond to the usual care and developed a general septic condition, with involvement of the meninges, resulting in death.

Extensive necrosis of the maxilla is rather uncommon, and when it occurs, it is usually limited to the alveolar process. In the mandible, necrosis is far more extensive and more common. Large parts of the bone, and, not infrequently, the whole bone, may be undergoing an extensive destructive osteitis, terminating in a large sequestrum.

Since my time is limited I will report, out of my observations, only two cases of suppurative osteitis involving the mandible, resulting in extensive necrosis and sequestration of the bone.

REPORT OF CASES

CASE 1.—*History.*—A man, aged 37, a Polish laborer, had been in robust health until July, 1915. He then experienced pain in the jaw from time to time. Two weeks later, there appeared a marked swelling on the left side of the mandible in the region of the third molar. He consulted his physician, who advised an operation. An incision was made below the angle of the mandible and from this a considerable amount of pus oozed. The wound was packed with iodoform gauze and dressed daily for six weks. The family dentist was then consulted, and he advised the removal of the second and third molars. This was done, with no improvement. The patient was thereupon referred to my oral surgery clinic at Marquette University.

Examination.—On admission, the temperature was 101. The patient was emaciated and there was a large swelling on the left side of the face, with marked trismus. Pus flowed freely from an open surgical wound beneath the mandible.

A roentgen-ray examination revealed a large area of bone involved, with a pathologic fracture in the region of the lower second molar. Bacteriologic examination of the pus revealed a mixed infection. The Wassermann examination and urinanalysis were negative. The physical findings as regards the internal organs were apparently normal. The mouth examination revealed nothing unusual except a chronic gingivitis around most of the remaining teeth. A probe passed into the suppurating wound traveled within the cancellous structure of the mandible, and upward toward the joint, which, to the sense of touch, demonstrated necrotic bone. By palpation, a crackling sound was obtained and a free movement of the bone involved.

Diagnosis.—Suppurative osteitis of the ramus and the body of the mandible up to the second bicuspid was diagnosed.

Treatment.—The patient was given the usual preoperative care. He was admitted to the surgical clinic, Oct. 26, 1916. Under ether anesthesia, an incision was made 2½ inches long below the body of the mandible, from the bicuspid, back. The periosteum and the soft tissues were gently retracted. The bone was now exposed and periosteal elevators were delicately inserted to free the periosteum from the diseased bone. The bone was gently removed from its bed by forceps.

The gloved index finger was then inserted in the wound and the field explored. The periosteum was found apparently normal and gave to the sense of touch a pocket-like feeling. Iodoform gauze was now packed into this pouch, and the wound was dressed and the remaining jaw immobilized. Three days later, the gauze, when removed, showed no pus. The temperature was normal and there was little swelling. Packing was again placed in the wound, and was removed forty-eight hours later. The wound was then left to heal by granulation.

Result.—Six weeks later, the patient was discharged, to report from time to time. Six months afterwards (by this time he had returned to work), I found the bone had been restored to a large extent and furnished a fair frame without any disfigurement to the facial lines.

CASE 2.—*History.*—Mrs. B, aged 28, a housewife, suffered from trismus dentium, caused by pericementitis of a partially erupted third molar. The tooth had been extracted but proper postoperative care had not been given the patient. Three days later, swelling increased, trismus became more marked and the pain was excruciating. The patient had been advised to apply antiphlogistin, which

she did for several days, with no relief. She thereupon consulted her physician, who promptly operated to relieve the pus formation, which by this time was palpable in the region of the clavicle. A drain was inserted and the pus flowed freely. This condition continued for three months. The patient was then referred to my oral surgery clinic at Marquette University Dental School (admitted to Trinity Hospital).

Examination.—There was marked swelling of the lower jaw and neck, with pus oozing from a wound over the clavicle; with severe trismus. The temperature was 99.6. The physical condition was good, with past history negative. Roentgen-ray examination revealed extensive bony involvement of a large part of the right mandible. Mouth examination revealed caries of a number of teeth, complicated by gingivitis. Pus oozed from the socket of the third molar, the first and second molars having been previously removed. On passing a probe into the socket of the extracted tooth, necrosis was detected.

Treatment.—The patient was given the usual preoperative care. She was admitted to the surgical clinic, March 28, 1916. Under ether anesthesia, a probe was passed into the wound lying over the clavicle, traveling up the fistulous tract to the mandible along the platysma myoides muscle. The mouth was then gently forced open with a screw gag. An incision 2 inches long was made directly over the alveolar ridge. After the soft tissues were stripped from the bone, the entire dead mass of bone was removed with a bone forceps. The probe, which had been placed in the fistulous tract, could now be passed into the pocket left by the bone which had been removed. Silk ligature was tied to the head of the probe and, to the other end, a strip of one-half inch gauze, 18 inches long, was attached. The gauze was then drawn down into the wound, to pass out at the clavicle, and the pocket of the wound in the mouth was packed with the rest of the iodoform gauze. The patient was then bandaged and put to bed.

Three days later, the gauze was removed. There was very little pus. The wound was repacked, this packing being removed forty-eight hours later. By this time, there was no further pus formation, and healing began to take place. The wound in the mouth was packed daily for ten days and then left to heal by frequent irrigation of the pocket each day with salt solution. Recovery was rapid and without complications, and the patient was discharged two weeks afterwards.

Result.—After a lapse of four months, further examination showed that a large portion of the bone had been restored.

These two cases illustrate the importance of mandibular bony involvements.

I am unable at this time to dwell on other causes of osteitis of the jaw bones such as the action of phosphorus, or specific infections, such as actinomycosis, tuberculosis, syphilis and malignant infiltrative growths.

I need not emphasize the utmost importance of a knowledge of underlying principles of pathologic-anatomic processes in order to understand correctly and interpret rightly the clinical pictures and to apply our surgical procedures rationally.

The treatment for all processes of infection of the jaws is an early, thorough drainage, in order to free the bone of the inflammatory products burdening it. Extensive curettage, even in hands of an experienced worker, is a dangerous procedure, as it may open new avenues of infection.

To keep an open mind and treat any complications that may arise on the basis of a sound training as regards the pathologic processes pertaining to bone diseases, combined with good surgical principles, is imperative.

Willington has well said, "There is the old saying for the treatment of all processes of suppuration of the jaw and its surroundings which has not yet lost its meaning: 'Ubi pus, ibi evacua!'" If the suppurative matter does not find its way clearly out of the alveolus after the diseased tooth has been removed, then the knife, guided by trained and experienced hands, makes way for it.

695 Astor Street.

OSTEITIS OF MANDIBLE AND MAXILLA*

By LEROY M. S. MINER, M.D., D.M.D., F.A.C.S., Boston, Massachusetts

IN the ten-year period 1916-1925 inclusive, 176 cases of osteitis of mandible or maxilla were treated in the wards of the Massachusetts General Hospital. The number treated in the outpatient departments was 101. Some of the latter cases were received from the wards, being discharged to the outpatient department.

Of the 176 cases, 100 were selected at random for study. Sixty of these were in males and forty in females. The youngest patient was 16 months old, the oldest, 78 years. Eighteen patients were under 10 years; eleven from 10 to 20; nineteen from 20 to 30, and seventeen from 30 to 40. Sixty-five per cent, therefore, occurred in patients under 40 years of age, and 18 per cent were under 10. Of the remaining patients, eleven were over 60 years.

The parts affected were: entire mandible, 3 cases; right mandible, 45; left mandible, 31; entire maxilla, 2; right maxilla, 13; left maxilla, 5; both mandible and maxilla, 1 case; total, 100 cases. It is interesting to note that 79 per cent of the cases occurred in the mandible and 57 per cent were on the right side. Only one case involved both mandible and maxilla.

ETIOLOGY

In a study of the etiology of these cases, seventy-three gave a positive history of tooth disturbance as the starting point of trouble with the jaw. Toothache, followed by filling or extraction, was the common history. In twenty-one cases, a tooth previously broken off in extraction was thought by the patient to be the cause of the trouble. Five cases gave a history of a blow, of which four were from a fist, one from a kick from a horse. One case followed a fall from a horse, and one case followed a bullet wound. Seven cases, therefore, had trauma as an etiologic background.

Of the remaining twenty cases, the history was either vague or uncertain, and therefore could be only recorded as undetermined.

Following is a résumé of etiologic factors: teeth, 73 cases; blows, 5 cases; fall, 1 case; bullet, 1 case; undetermined, 20 cases; total, 100 cases. These figures rather substantiate Blair and Brown's statement that "it is, all things considered, a safe clinical bet that prevention of decay and injury of the teeth will prevent possibly quite a large percentage of these bone infections."

Syphilis has often been regarded as as etiologic factor of more or less importance. Four cases in this group gave a positive Wassermann reaction, two, a 4+. Thirty cases were negative. In one of these cases, in a 16 months old boy, in which syphilis was suspected, the reactions of the father and the mother were also negative. In sixty-six cases, no Wassermann test was made. A résumé of cases shows: posi-

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tive, four; negative, thirty; no test, sixty-six; total, 100.

In two of the four positive cases that came under my care, the tooth symptoms were first to develop and were prominent in the mind of the patient, but probably these were secondary to the syphilitic infection. How many positive reactions might have been found in the group of sixty-six in which no tests were made is, of course, problematic. When routine Wassermann tests are made in unsuspected cases, less than three out of 100 are found by a Boston clinician to be positive.

DIAGNOSIS

In my experience, osteitis of the jaws has two distinct stages in a large percentage of cases. There is first the acute stage, the symptoms being characteristic of an acute inflammation associated with an active infection. In this stage, an accurate diagnosis is frequently impossible, for the symptoms are practically the same as in acute dentoalveolar abscess. Second, there is the chronic stage, which appears after the acute symptoms have somewhat abated. The continuation of all symptoms in a mild form, including discharge of pus, usually indicates the presence of a true osteitis.

In the group of cases studied, forty-one patients were admitted to the hospital in the acute stage; 59, in the chronic stage. In the forty-one acute cases, fourteen patients were later readmitted for treatment of the chronic condition. It is entirely possible that a percentage of these forty-one cases were not true osteitis, particularly seven cases in which local applications were sufficient for relief.

The temperature records show an average high recording in the acute cases of 101.5 degrees; while, in the chronic cases, the average is a fraction under 100 F.

ROENTGEN-RAY DIAGNOSIS

In the acute stage, the roentgen ray is of indifferent value except to indicate possible etiologic factors of a dental or traumatic character. Changes in the cellular structure are not sufficiently marked to show in roentgen-ray projection except in the very virulent cases. In the chronic stage, the roentgen ray is, of course, of great service.

In all but two of the cases studied, the roentgen-ray diagnosis, when one was made, was confirmed later by the postoperative diagnosis. One case was diagnosed as probably malignant, and in the second, a tentative diagnosis of Paget's disease or of actinomycoses was made. Both cases, microscopically, were chronic inflammation.

TREATMENT

Thomas Fillebrown, professor of oral surgery for many years at Harvard, used to say that the best treatment for osteitis was patience. This observation applies, of course, to the chronic phase during sequestration. During the early part of the acute state, cold or hot packs may be of service to prevent tissue destruction and extension of the disease. In seven cases already referred to, only local applications were used. These cases were discharged as relieved. Incision and drainage was the procedure in the remaining cases. Prompt relief of the acute symptoms follows this treatment as a rule. The use of a curet here usually indicates poor judgment. The important consideration in the treatment of the chronic phase is the time to do sequestrectomy. Blair and Brown say "it is difficult to set an exact

time but in the ordinary straight forward acute osteomyelitis of the jaw dead bone will have separated itself in ninety days."

In attempting to get statistics regarding sequestration, the unreliability of the patients' memory and the inaccuracy of their statements make the figures of doubtful value. In fifty-eight cases of the series, sequestrectomy was performed.

The longest duration of the disease, as given by the patient, was forty years (a sequestrectomy was performed in this case), and the shortest time was three weeks. I have seen sequestration take place in seven days in the violent type. From six to twelve weeks was the average duration of the series, with the peak toward the low rather than toward the high extreme.

HOSPITALIZATION

In the acute phase, the average hospital stay was nine and one half days; in the chronic stage, fifteen days.

COMPLICATIONS OF TREATMENT

The physical condition of the patient is sometimes an important consideration in the matter of treatment. In a recent case, the patient had a cardio-renal syndrome, and, while waiting for operation, had a pulmonary thrombus, which nearly caused death. At no time since has the condition made it possible to care adequately for the jaw condition.

Fractures, extension of infection to maxillary and frontal sinuses and to temporal bone, septicemia, cellulitis, acute cervical adenitis, tetany, tuberculosis and endocarditis were all seen in this series. There were three cases in which the temporal bone was invaded.

RESULTS OF TREATMENT

There were three deaths in this series of 100 cases. Osteomyelitis of the jaw is not regarded as particularly serious, and yet the mortality happened to be as high as it is in other conditions regarded as more important.

If treatment has been fundamentally sound there should be no deformtiy nor limitation of motion. Both of these unfortunate sequelae are seen occasionally, and serve to emphasize the need of correct treatment.

The onset, progress, course and treatment of osteomyelitis of the mandible is fairly well illustrated by the following case.

REPORT OF CASE

A physician, aged 53, suffered from toothache in the lower right jaw. Extraction was performed, with nerve block anesthesia. The jaw was stiff the following day, with severe pain. Swelling was pronounced in thirty-six hours, with increasing pain and progressive trismus. In four days, there was marked swelling and the pain was unbearable. Ice packs gave no relief. Hot poultices were used on the sixth day. Incision and drainage was carried out at the hospital on the seventh day, and a large amount of pus was evacuated. A drop in temperature and recession of other symptoms followed. Some swelling and discharge of pus continued. After two weeks the swelling increased again. Drainage was insufficient. At the fourth week, in consultation, I found extensive destruction of bone of both the horizontal and ascending ramus. Sequestrectomy was performed on the forty-second day. Three large sequestra were easily removed. The involucrum was well organized. The patient was in hospital for this operation eleven days, and was discharged to a local hospital. Four weeks later (ten weeks from onset), another sequestrum exfoliated. At twelve weeks, the swelling was practically gone. Motion is still somewhat limited, but is improving daily. There is no deformity.

363 Marlboro Street.

THE SERVICE RENDERED BY FIXED BRIDGEWORK*

By ROY JAMES RINEHART, D.D.S., F.A.C.D., Kansas City, Missouri

DENTISTRY AS A PROFESSION

DENTISTRY as a profession and as an organized speciality in the art of healing and repairing the dental organs and surrounding tissues is less than a century old. Dentistry as a mechanical art has been practiced as far back as we have records of human history.

Greek and Roman literature tells us of artificial teeth made of bone and ivory and anchored in the mouth by means of gold bands and wire. A noted ancient feminine character is mentioned as riding through the streets in a chariot and losing her false teeth and false hair.

Present-day dental literature will tell future generations of many ingenious devices, both fixed and removable, with technic described in detail. Some investigators of the future will read with great interest of the seemingly simple and undeveloped stage. Extremely interesting and somewhat confusing situations have confronted the profession during the present period.

Efforts have been continuous in all periods to relieve humanity of the suffering caused by defective dentition and to restore the organs of mastication to a comfortable and usable condition, as well as to produce esthetically the teeth visible.

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Dentistry of today is making itself felt as a healing and preventive health service as well as a restorative agent. Scientific developments are revolutionizing the practice of the art, and now the profession regards its responsibilities from a radically different point of view.

CROWN AND BRIDGE WORK

In considering the subject of crown and bridge work, the first factor of importance is the physical effects resulting from the application of wrong practices. The problems of focal infection at the apices of pulpless teeth, the excessive preparation on vital teeth, the irritating and insanitary conditions of improperly fitted and constructed crowns and pontics, and malocclusion are most apparent.

Bridgework is of two distinct kinds, fixed and removable; and too often the term, "removable bridgework" has been used when, in reality, a partial denture is meant. The service rendered by fixed bridgework cannot be questioned by anyone who is well informed.

Some members of the medical profession have rendered snap judgment to patients regarding the presence of gold crowns, not really knowing whether their presence was damaging or not. The dental profession knows that well constructed gold crowns upon healthy teeth are not a menace to the general health of the patient, and if dentistry is to continue rendering its valuable service, the gold crown must remain.

Many physicians have not taken into consideration the fact that a gold crown properly constructed is not different from a partial crown. The habit of looking into a mouth in which there are gold crowns, and condemning the whole denture, has caused great embarrassment. A thorough understanding with the medical profession concerning this subject should be brought about by the various local societies throughout the country.

The radical condemnation of fixed bridgework in favor of removable by some men, and the impression that this has made on the minds of the medical profession, are fresh in our memories; but like a stream with many muddy streaks in it, the problem needs to be stirred from the bottom and the muddy places will become clear. Unpleasant experiences and failures never leave us where they find us. If we are honest and desirous for the best, we shall find ourselves being led toward a more perfect result. So again, the pendulum swings, and fixed bridgework comes back with a new dress of modern design.

CONSULTATION AND DIAGNOSIS

The dentist should be a wise, conscientious and deliberate counselor. Nothing in this material world is everlasting, dental restoration included, and the patient should be so advised. The crown or bridge can be no more permanent as a usable substitute than the teeth themselves. Frequent inspection is absolutely necessary.

An automobile is sold to a customer with instructions of frequent inspection, lubrication, adjustment, etc. The purchaser pays a generous sum and understands about the upkeep and continued expense, and also the fact he will probably need a new model in a couple of years. It is a matter of education. The automobile dealers speak out and state the facts. They all tell the same facts, and owners believe and act accordingly. Dental work is not different. The patients are the same people who buy automobiles and, in fact, all other things perishable. Dental restorations are not permanent; they are temporary substitutes. If properly and honestly constructed and properly cared for, they give most excellent service as substitutes. Too often, a bridge means so much gold and porcelain for so much money. A bridge should mean infinitely more. Mastication is its main function. The health and comfort of the patient should be the result. A technician can construct a bridge, correct in anatomic design and beautifully finished; but without the proper diagnosis of mouth conditions and a conformity to scientific principles, the crown or bridge would be worthless; in fact, injurious. A knowledge of embryology, histology, anatomy of the jaws and teeth, physiology, bacteriology and pathology is the basis of diagnosis. The dental examination, consultation and the radiogram are all necessary. The radiogram does not tell the whole story any more than the dental examination does. The patient must understand what you find so that the responsibility rests with him.

The dentist should be scientific and practical, and his experiences will enlarge his base and extend his borders of understanding. These qualities, with the practice of the Golden Rule, give a public service that is safe, sane and reasonable.

PRACTICE AND PRINCIPLES

Only a few years ago, the generally accepted practice was to attempt to retain

all teeth, regardless of conditions. Attaching a bridge to a vital tooth was cause for criticism. Dentists knew little of the diseased conditions under the gums and practically nothing of the general results. Comfortable use was the main consideration. Esthetics was gradually given considerable attention, but anchorage, strength and bulk satisfied the average patient and gave assurance to the practitioner that the denture would stay and could be used. Irritation and sanitation were, in many instances, disregarded, and the restoration of natural tooth form was approximated only relatively. Missing teeth are often yet replaced without due consideration of proper occlusion, although it is well established that closure of a bite due to missing teeth and abrasion may cause impaired hearing.

It is an easy thing for a man to fall a victim to habits not conducive to the best results, and these habits and practices will be broken only when he realizes the damage he may do, and has a conscientious desire to change for the better. Filling a cavity in a tooth or filling a vacancy, and disregarding the rest of the oral cavity as well as the general health of the patient, does not represent the present standards of the dental profession.

From a construction standpoint, study casts should be made and charts filled in, so that definite plans and specifications may be thought out. The practice in architecture and engineering should be a lesson to the dentist. It would be unthinkable to build an expensive structure without detailed plans and specifications. The dentistry of today demands a scientific procedure.

An extremely perplexing question before the profession is: Shall all pulpless teeth be extracted? This subject cannot be discussed here. I firmly believe in the employment of vital teeth for anchorages, but I do not condemn all pulpless teeth. It must be remembered that the patient must be advised of facts, as well as of prevalent theories, and he must cooperate and shoulder the responsibility that is his. The patient and dentist must establish faith and confidence for the best results.

We may sum up the situation thus far with a few rules:

1. In preliminary consultation, advise the patient in detail of methods of procedure. Understanding is the basis of all harmonious business and social relations.
2. Make the examination thorough.
3. Mark for elimination all doubtful teeth; start with a clean field.
4. Make study casts and arrive at a complete plan for the work before starting operation.

REMOVABLE BRIDGES

There are some who still condemn fixed bridges as insanitary and irritating, and advise the use of removable structures as the best practice.

The human mind does not find it difficult to be led away by fads and to accept some new theory as practical before it has been given the test of time. When it was revealed that some practices were not successful and were not what they considered them to be, the profession was eager to do anything that would correct the errors. It is no wonder that an extreme stand has been taken by some members of both the the dental and the medical profession.

When the subject of removable bridgework is reviewed, with the claims made for it, it will be found that the main objection to fixed bridgework is not obviated by removable work; and

the problem of using a vital tooth or devitalizing the tooth is as much in evidence in one system as in the other. The claim that there is less stress on the abutment teeth, and that the teeth are allowed to move in function, seems to be more of a theory than a practical reality. That the piece of work can be removed and cleaned by the patient is true, but the fact that the removable bridge must be removed before the patient can enjoy any comfort after eating is also true. Fixed bridgework of proper design can be cleaned as readily and as effectively with the toothbrush as can the natural teeth, and even more so.

Many ingenious devices for attachments of removable bridges have been invented and advocated, but, as yet, none of these are ideal. The cast clasp works, but if placed on a normal tooth, the enamel will disintegrate unless great care is taken by the patient. The clasps often produce sensitiveness. The piece of work is as rigid as a fixed bridge. If the bridge is extensive, the same problem presents itself, as in the case of an extensive fixed bridge. When a tongue and groove attachment is used where the tongue can settle into the groove as the saddle settles upon the tissue, as it will do, the occlusion is soon lost. The readjustments and repairs on most of the removable bridgework that many dentists have constructed and delivered to their patients are exceedingly annoying and expensive to both patient and dentist, and much of the work has been constantly uncomfortable and irritating.

When the patient has lost most of the teeth and the space to be filled is too large for the consideration of fixed bridgework, the problem becomes a matter of partial dentures, and the fewer attachments of a simple nature used, the more satisfactory, useful and permanent the result.

Removable bridgework, as generally practiced has the following faults: (1) instability; (2) distortion and frequent breakage of attachments; (3) irritation to the surrounding tissues of teeth carrying the anchorage; (4) disintegration of the anchorage teeth, and with some systems, an excessive preparation for anchorage; (5) accumulation of food.

FIXED BRIDGEWORK

When it was realized that a different type of bridgework was demanded, there were about four outstanding ideas regarding solution of the problem: 1. The use of vital teeth as abutments with a minimum sacrifice of tooth structure in their preparation. 2. Construction of a piece of work that the toothbrush would render as measurably clean as the natural teeth. 3. Establishment of correct occlusion and not merely articulation. Occlusion in dentistry means the proper masticating relation of the upper and the lower teeth. 4. Use of precious metal, rigid and tenacious enough to maintain its position as an anchorage under the stress of mastication.

ABUTMENTS AND ATTACHMENTS

Richmond crowns, gold crowns and open faced crowns have their place, but the technic herein described will be confined to the newer type of attachment, the partial crown. This type of attachment can be placed upon any of the teeth.

The teeth to be used as abutments must be free from calculus and rendered as healthy as possible. The shape of the teeth should be studied and all of the characteristics in the use of the teeth taken into consideration. It will

be readily seen in what manner the teeth have been naturally ground, and bridgework that will conform to the individual use should be constructed.

The attachments known as three-quarter or partial crowns cover the lingual, mesial, distal and incisal or occlusal surfaces, leaving the labial or buccal, as the case may be, untouched.

A careful study of an accurately made plaster cast will be found advantageous in selecting and using the various instruments and stones in the preparation.

PREPARATION OF ANTERIOR TEETH FOR PARTIAL CROWN

The attachment to be described covers the lingual, mesial, distal and incisal edge of the teeth, and the plan is to remove a minimum amount of tooth substance and yet have adequate strength, making sufficient preparation for anchorage and avoiding the appearance of gold as much as is practicable. It should not be required here to call attention to the precautions necessary when grinding on the surfaces of vital teeth, nor should it be necessary to describe the various instruments and stones to be used, except in two or three instances.

The first step in preparation is to remove a sufficient amount of tooth structure on the lingual surface to allow the replacement of a plate of gold about 1.5 mm. thick.

The next step is the mesial and distal preparation. Fine abrasive linen strips should be used to strip down and separate the contact points slightly. A lightning disk is then effectively used to gain access. At this point, there are two methods that may be followed, one being a complete slice through with a one-sided abrasive disk. With the other method, after the lightning disk has been used slightly, the one-sided abrasive disk is used, coming from the lingual side, but not extending through to the labial, the lightning disk having given just enough separation for the proper taking of the impression and for the margin of the gold to extend to the labial surface. The length of the bridge and the form of the tooth will largely determine which method is most practicable. Preparation must be extensive enough to give adequate strength.

A groove extending from the incisal to the gingival edge, just back of the labial plate of enamel, is made, and the finishing of this groove should be made with a smooth fissure bur, No. 57. The finishing of the groove at the gingival may be left as a step, or may be sloped off to the outside of the tooth. In either case, the gold should extend slightly beyond the groove. The grooves must be parallel, and they must also be parallel with the grooves in the other abutment or abutments. No incisal groove is necessary, but the incisal edge of the tooth should be ground off to be slightly sloping, the preparation being similar to that of a facing for a Richmond crown.

BICUSPIDS AND MOLARS

There are two types of partial crowns for bicuspids and molars, and these two types may have variations, according to the strength and anchorage demanded. The first type that we shall consider covers the lingual, mesial, distal and occlusal, leaving the buccal side of the tooth exposed. The slice preparation through the contact points, giving parallelism mesially and distally, is preferable. A square shoulder preparation is not best, for the reason that an accurate casting is not easily obtained;

therefore, a beveled or sloping shoulder is advised. The lingual surface is ground down sufficiently that the beveled shoulder may continue around this surface. In grinding the occlusal surface, the various planes should be maintained, and just enough taken off so that the casting will be about 2 mm. thick. A groove across the occlusal is unnecessary. The buccal cusp is trimmed off slightly so that it will be entirely covered with gold. In the case of the molars, it has been found excellent practice to extend the preparation slightly over the buccal cusps. This forms an anchorage on all four sides of the tooth. The grooves, mesially and distally from the occlusal surface, well beyond the contact point gingivally, are necessary.

The second method of preparation for a partial crown is to slice the tooth mesially and distally, the technic being the same as previously described; also, the lingual and occlusal preparation should be as described, dropping down on the buccal about half way. This is especially indicated in the case of an isolated lower second or third molar.

Still another type extremely practical is the use of a first or second molar as anchorage, the tooth posterior to the tooth on which the preparation is to be made being in its proper place. The preparation may be made without interfering with the distal surface or contact point of the tooth, the anchorage covering just the anterior half of the occlusal, buccal and lingual surfaces and around the anterior portion of the tooth. This makes an anterior half crown. The preparation is made by deepening the buccal groove with an abrasive disk and extending this groove across the occlusal and down the lingual side in the same manner, always being sure to bevel the margins. The enamel is ground off on the anterior half of the tooth. The sloping shoulder will extend from the groove made on the lingual side around to the buccal groove.

It must always be borne in mind that anchorage is an essential quality, and unless the preparation is made with approximately paralleled walls and grooves of sufficient length and depth, the attachment may be easily loosened. A round groove fully half the depth of the thickness of a No. 57 fissure bur is necessary for adequate anchorage. The cast that extends around any portion of the tooth, clasping the tooth from two or more sides, gives the best results.

An inlay for a bridge attachment is unsatisfactory because the dentin gives more or less under stress and, also, the tooth frequently fractures. An inlay may be used for a loose or movable connection, together with a partial or three-quarter anchorage on the other end.

IMPRESSION OF THE PREPARED TOOTH AND CASTING

There are two well known methods of making the casting, the direct and the indirect. The method that produces the best results in the hands of the individual operator is the one that should be used. The following is an effective procedure: An impression is secured in modeling compound encased in a copper or aluminum cylinder. The compound must be warmed over a flame, never in water, and in order for it to adhere to the cylinder, a hot instrument should be used to sear the compound to the edge. The entire cylinder is now warmed over a flame and pushed on to the tooth the full distance that it is expected to go, then the finger is placed on the other

end and the compound thoroughly compressed. When sufficiently hard the compound is removed. The impression is packed with alloy, either copper or silver, but in either case the alloy should set twenty-four hours. Other materials now advocated for this purpose may be used with equal certainty.

The waxed pattern is now formed on the amalgam die, and is then removed, and the casting is made. After pickling and scrubbing with a brush, it is placed upon the amalgam die and gently swaged. All grinding of the gold should take place while the casting is on the die, to avoid distorting and to protect the margins.

ACCURATE METHOD OF MAKING A CASTING

When the die of amalgam has been made, a sheet of 28-gage wax is carefully adjusted, giving the entire outline of the finished casting. It is then removed and cast with pure gold. When pickled and scrubbed, the casting is placed on the die and swaged. This forms an accurate coping, in form the same as that of the prepared tooth. The coping is oiled and the inlay wax is now added and carved to occlusion and contour. A slight margin of gold is left uncovered all the way round. The wax is slipped off the gold coping and the operator proceeds with the casting, using hard gold in the usual way. This casting is now placed over the pure gold coping. The two pieces are placed in a swager and gently swaged together.

The patient is now called in; the casting is fitted on the tooth, and the pure gold margins are burnished tightly to the tooth. It will readily be seen that pure gold margins uncovered by the hard gold offer the opportunity for accurate burnishing. The casting is removed, invested and joined with twenty carat solder, a union of the pure gold margin and the casting of the hard gold resulting. This method is being used by many accurate workers, and is found very effective. The reason that many anchorages prove to be failures is a lack of accuracy.

PREPARATION OF THE AMALGAM FOR THE DIE

It is well known by all amalgam workers that thorough trituration is necessary for denseness and hardness. Therefore, the amalgam should be thoroughly triturated at least three separate times, some of the excess mercury being squeezed out each time. It will be found that, although it is quite dry the second and third time that it is placed back in the mortar, thorough trituration will produce a salve-like mass in a short time. The amalgam must be fairly soft and pliable in order to make a perfectly smooth die. A toothpick or stem of a match is the best kind of plugger. As packing takes place, the excess mercury comes to the top and may be removed. The excess amalgam, after the impression is full, may be added for convenience in handling.

MATERIALS

These castings should never be made from ordinary gold, but always with the gold alloys that are especially prepared for this purpose. Practically all of the golds on the market have been thoroughly tested by competent metallurgists, and their use is correspondingly successful. There is one important point that should be borne in mind: the gold should not be melted more than once or twice for castings, and the buttons should be returned for refining.

If these golds are overheated, or remelted several times, there seems to be a separation of the metals, and often a casting will be found brittle and the bridge will break after a short time. Casting should take place as soon as the metal will flow properly.

IMPRESSIONS AND CASTS

When the anchorages are perfectly fitted in the mouth, an impression of the full upper and lower denture should be taken, and plaster casts made and mounted on an articulator. Bridges made for one side without due consideration of the other side, and of the proper movements of the jaws, do not produce the best results.

PONTICS

There are several types of pontics, each having a place. Each tooth to be supplied should be separately constructed. They should be tapering or conical, so that only a small surface rests on the gum, but so shaped to present a natural and artistic appearance. Lower posterior pontics should just escape the tissue. Facings should resemble the natural teeth on the opposite side in form and length.

An esthetic, cleanly and nonirritating type is made by using a long pin facing with added porcelain tip on the ridge lap and cast occlusal surface; but the porcelain tip should not extend into the sockets farther than the distance allowed for shrinkage. Other types of facings and other methods are, of course, effectively used.

Many posterior pontics are made with too large an occusal surface. They should seldom be as wide buccolingually as the original tooth. Closely articulated bridgework, made without due regard to the natural occlusion, is responsible for the loss of many of the abutment teeth. Wide pontics give undue use and stress to the abutment teeth. Again, a narrow pontic can be constructed so that it will be much more sanitary.

The porcelain tip is most nearly ideal when the bridge is made before extraction, the tip being made just long enough and with a slight saddle to fit the gum after healing and shrinkage have taken place. Long porcelain roots extending into the sockets have been found damaging, but a glazed tip is clean and nonirritating and its esthetic value cannot be overestimated, even though the gums should shrink slightly away from it. It is not difficult to make this type of pontic. No great knowledge of porcelain work or shading is necessary, and anyone can learn to bake these tips with a little experimenting in his own laboratory.

The conical shaped or pyramid type of pontic is easily cleaned by the toothbrush, lingually and buccally; in fact, it is more easily cleaned and kept clean than are the natural teeth.

ASSEMBLING AND SOLDERING OF THE DIFFERENT PARTS OF THE BRIDGE

In every case, all pontics should be separately made and finished up to the final polishing, then assembled in their proper places, waxed together and soldered at the contact point. This leaves a generous interdental space, which is necessary as a sanitary measure. The soldered points should have a finished surface all the way around, no rough edges or unfinished places remaining. When the attachments are joined to the pontics, solder should extend to the lingual side for the reason that, when it is soldered only to the mesial or distal wing of the attachment, there may not

be sufficient strength to withstand the stress. Setting a bridge is of no less importance than proper construction.

The finished bridge should be well polished, with margins of accurate design. The delivery to the patient of a piece of art, as well as a scientific product, establishes confidence and respect.

The more we reflect on this branch of dentistry, the more we realize its importance, its magnitude and its demands. It is a science and an art comparable to the most important in the requirements of mankind. The tragedies that have passed should be lessons for today.

Revolution is the demand of evolution. In this age, the wheels of progress are turning rapidly. Today passes and the morrow comes with added problems and new designs. The highway leading toward the goal is open. It can truly be said that dentistry is in step with the procession.

The Rev. R. A. Waite has said, "Civilization is taking the good of yesterday, making it the better of today, that it may become the best of tomorrow."

DISCUSSION

E. H. Hubbuch, Louisville, Ky.: What percentage of dentists live up to the Golden Rule? To do so means service, in any department of dentistry, in any work of life. In studying crown and bridge work, probably a dozen times during the year the attention of the student body is called to it by such a statement as this: "Never place in any mouth any piece of work that you would not have placed in your own." Many bridges, fixed and removable, would not be placed, if this rule prevailed. Overtaxed abutments, ill-fitting crowns, lack of contact point, loosening of the piece from the abutment, unhygienic form, poor articulation and inartistic design have caused some condemnation of fixed bridgework. It should not be judged by these poor examples any more than mankind should be judged by the examples of it found in our penitentiaries and asylums. Work of this kind is attributable either to lack of ability or to unscrupulousness. A fixed bridge, to be serviceable, must be indicated. Study casts well made and articulated are indispensable except in the smaller constructions in order that one may know whether fixed work is indicated. They serve, too, to aid in planning, engineering, if you please, and determining in our minds just what the finished product will look like and how it will function. As stated by Dr. Rinehart, a complete examination of teeth and surrounding tissue must be made in this same connection. The number of teeth needed for abutments, and their location and stability must be taken into consideration. The types of abutment pieces that will be most serviceable in the given case must be reviewed, the operator bearing well in mind the fact that a fixed bridge, to be setviceable, must function properly. The selection of the type of pontic best suited to the case is a question that we must consider and decide, and we can then see the finished product in our mind's eye. One must not lose sight of the esthetic effect in making a choice, and in this connection, it is well to say that that which is most natural in appearance is best, unless obtained at a sacrifice of strength and durability. The hygienic arrangement of the integral parts must be well studied and planned; for it is here that the attack on fixed work is centered. To me, the designing of a bridge of the fixed type is the most difficult part of dentistry. Next comes the realization of this mental picture. Great mechanical skill and manipulative ability is required of the practitioner of crown and bridge work. Otherwise the idea formulated with such effort would be wasted. But when the details of planning and construction of a fixed bridge and its placement with all requirements fulfilled are consummated, what a compensation is ours in having conscientiously given to our patients a service that they are entitled to. Fixed bridgework, when indicated, properly planned as to function, hygiene and natural appearance, and properly constructed affords an immeasurable service.

FIXED BRIDGE RESTORATIONS; THEIR INDICATIONS, LIMITATIONS AND CONSTRUCTION*

By A. O. KLAFFENBACH, D.D.S., Iowa City, Iowa

A PERIOD of agitation must sometimes precede a needed change. The profession must be made aware that a given condition or practice is unsatisfactory and must also be convinced that the proposed change will bring about improvement.

During the past few years, the ever-present problem of supplying missing teeth has been greatly in evidence, and much has been written, published and said for and against fixed and removable restorations.

The theories and practices propounded as a logical sequence have served as searchlights, casting their light into dark places and thus enabling us to see, sometimes plainly, sometimes only in dim outline, much that would remain hidden if it were not for this controversy. Even though much good has been derived from this altercation, it does not seem that this should be the paramount issue. Fundamentally, both fixed and removable restorations are based upon the same considerations; an unnatural strain or overload being placed on every tooth utilized as an abutment or indirectly supporting or retaining the appliance. Therefore, the problem evolves itself into how best to supply the edentulous spaces for each individual.

It is self-evident that artificial restorations of any kind are undesirable. However, if the appliances are constructed according to basic principles, the artificial teeth are more desirable than none, even though the method of attachment and retention must be the choice between the lesser of two evils.

It is also self-evident that, in most cases, these edentulous spaces must not remain long without some kind of restoration. Not only does the loss of teeth decrease function, but also, in time, certain retrogressive changes take place which bring about tipping and elongation of the teeth, with little or no contact, and later perhaps, a change in the relationship of the two arches. Thus, functional occlusion may be changed to malocclusion, which invariably leads to pathologic lesions. For this reason, the chief object in bridge restorations should be to restore and maintain function and unity in the human machinism of mastication.

In order to do this, we must be able to make an intelligent and correct diagnosis; and to differentiate between physiologic and pathologic tissues, we must have a scientific knowledge of the mechanical, physiologic, anatomic and hygienic requirements, and, lastly, must be able to plan, construct, and restore

*Read before the Section on Partial Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

the broken units artfully and have them meet the requirements.

It is a matter of common observation that fixed restorations have been much abused. A case which recently came under my observation will be briefly described: a woman, aged about 60, had an upper fourteen-piece bridge held in place by two second molar gold shell crowns, the anterior portion being supported by two small saddles in the region of the cuspids. On the lower right side was a seven piece bridge with gold shell crown on the lateral incisor, cuspid and third molar, the lower left side being restored with a six piece bridge with a gold shell crown on the lateral incisor and cuspid, and a small saddle in the region of the second molar.

Obviously, there was something wrong; in fact, everything was wrong: poorly contoured and ill-fitting gold shell crowns; inadequate support; no regard for occlusion; broad occlusal platforms with no embrasures; no attempt to reduce the occlusal area, relieve stress or overload, and, lastly, no provision for oral hygiene.

No wonder fixed restorations have been condemned when such replacements are being made. But is it just to condemn the practice because some dentist was ignorant, careless, incompetent, avaricious or a combination of all of them? We all realize that patients would be better off without restorations of this kind. However, it is a satisfaction to know that servicable, hygienic and satisfactory replacements can and are being made. This being the case, it follows that the dentist of today must keep abreast of the times in order to exercise superior judgment and skill in this particular branch of dentistry.

On the other hand, along with the oral hygiene movement, it would be well to instruct the public in the use and abuse, as well as the possibilities, of dental restorations, so that they will be able to judge the kind of service that is being rendered.

Clinical evidence has repeatedly demonstrated that fixed restorations have failed, not because they were fixed, but because of inadequate support, poorly fitted and constructed abutment pieces, insufficient attachments, and disregard for pathologic conditions, with no attempt to maintain physiologic tone. While there are many cases in which partial dentures or removable bridges will best meet the requirements of the patient, there are others in which the most serviceable, comfortable and esthetic replacements are afforded by the fixed bridge. So progressively and efficiently has the application of the casting process, in the construction of dental restorations, proceeded during the past nineteen years that we can scarcely realize what an important factor it has been in bringing about many needed changes. By means of it, we have been able to utilize inlay three-quarter crowns and various other types of cast abutment pieces on vital teeth, and without subsequent irritation of the tissue.

Hand in hand with the casting process have come the various kinds of casting golds, formulated to meet the demands of these newer forms of abutment pieces. By use of these platinized golds or alloys, we can construct rigid abutment pieces smaller in size, and not so conspicuous.

Dental porcelain also has played an important rôle, enabling us to construct esthetic restorations that are compatible with the soft tissues. Its hygienic qual-

ities, too, are greatly in its favor; for the gelatinous film found so frequently adhering to gold does not coat highly glazed porcelain. One of the disadvantages of previous efforts was, at times, the shocking display of gold. This can be obviated by the use of more porcelain and less gold, porcelain being considered the one substance which most closely simulates nature.

The practice of devitalizing teeth and the use of devitalized teeth with unfilled or poorly filled root canals for abutments has resulted in many failures. Pulp conservation is of vital importance; consequently, abutment pieces should be so planned and constructed that there will be no pulp involvement. All castings should slide to place with very slight frictional retention, but should not fit so tight that excessive pressure will be brought to bear on the dentin, causing the latter to yield sufficiently to cause pressure upon it.

Only recently, Charles F. Bödecker has proved "the presence of an organic matrix in the enamel and the connection of this organic matrix with the lymph of the general circulation." He also states that, even though the theory that inorganic salts may be deposited in this manner after the eruption of the teeth, and that these salts may again be removed under certain pathologic conditions, is not yet proved, he believes that the profession should not dismiss the possibilities of general pathologic conditions affecting the teeth by means of the circulation. With this knowledge, it would be unwise to use abutment pieces, which involve all surfaces of the crown of a vital tooth, such as the full cast or shell crown.

The question of fixation of the abutments has long been a debatable one, but clinical evidence has shown tissue tolerance for short span bridges. It must be admitted that a physiologic abutment is preferable, but as a normal tooth can move only slightly apically, buccally, lingually and occlusally in the normal arch, a fixed bridge does not limit movement as much as at first might appear.

The great destructive factor in restorations of this kind is abnormal stress or traumatic occlusion, a reasonable amount of overload being tolerated; for, in all cases, there is a diminution in the crushing efficiency of the restored side as compared with that of the normal. In a series of tests made, this varied considerably, and, in some cases, ran as high as 20 pounds for a bridge with one molar pontic in a mouth registering a crushing strength of 85 pounds on the normal side. This would indicate that the teeth carrying the bridge will bear just so much pressure, the patient being warned when more than that is applied.

In the construction of pontics, it is imperative that anatomic form, efficiency, functional occlusion and esthetics be given due consideration. Interproximal spaces and embrasures should be slightly enlarged to facilitate cleansing and to permit food to massage the gums during the process of mastication.

Wherever pontics with porcelain tips are used, they should be high-fusing (2300 F.), so that, if it is necessary to grind or alter the overfused surface at the final sitting, it can again be reglazed with a lower fusing porcelain. In most cases, these tips should come in contact with or fit accurately to the gum to prevent food collecting under them, but they must not press sufficiently hard to cause irritation.

The practice of implanting porcelain tips in the sockets immediately after extraction is fast sinking into disuse because of the many failures resulting from the injudicious placement of this type of pontic. In these cases, excessive absorption took place, exposing the porcelain tips. Occasionally, one tooth is to be replaced, without apical involvement, and where the labial plate is of sufficient thickness. In such cases, an overglazed implantation may be used provided the porcelain tip is not more than one fourth the length of the extracted root; fills the orifice of the socket without undue pressure, and tapers uniformly to its apex.

Where some tissue has been lost or absorbed, pink porcelain may at times be used to advantage, a more esthetic restoration resulting. Where there has been extensive absorption and a saddle is indicated, the removable restoration should always be used.

There is, at present, a tendency to resort again to the semifixed restorations, uniting one end of the pontic rigidly to a retaining abutment piece and, by means of some type of lug, such as the occlusal support, pin and socket or ball and socket, procure individual mobility for both the retaining and the supporting abutments. This is particularly advantageous when it becomes necessary to restore teeth of different function and also when a restoration with an intervening abutment is to be made; i. e., when the first bicuspid and the first molar on the same side and arch are to be supplied. In a case of this kind, stress would be broken at the distal of the second bicuspid and the distal of the cuspid, more or less individual movement being thus permitted the two molars, the two bicuspids and the cuspid.

As a rule, tipped teeth are unsatisfactory for abutments. However, by means of a lug, a very satisfactory semifixed restoration can be made without the excessive tooth mutilation that would be necessary to parallel them for a fixed appliance. In addition to this, by utilizing broken stress, the size of the supporting inlay can often be reduced, tooth tissue being thereby conserved and the display of gold avoided on the mesial surface of the abutment.

While this type of restoration does permit of individual movement, it must be constructed with great care, for the movement of normal teeth is slight. If not properly constructed, there is ultimate danger of abnormal or excessive movement, resulting in a loosening and possibly a subsequent loss of the retaining abutment tooth.

In this brief analysis, it is impossible to cover completely fixed bridge restorations; nor is it possible to enter into detail concerning its construction. This has not been the purpose of this paper, but rather to emphasize the importance of correct diagnosis, prognosis, and construction and also the limitations of this type of restoration.

An ideal, specific method for restoring the lost natural teeth has not yet been found, and it is doubtful that it ever will be; but successful substitution for them can be made, where indicated, by means of fixed restorations that will efficiently, comfortably, hygienically and esthetically meet the requirements of the patient.

DISCUSSION

R. E. MacBoyle, Chicago, Ill.: Dr. Klaffenbach has given us many valuable and helpful suggestions for meeting the problems of fixed bridgework. He tells us that much has been

written, published and said for and against fixed and removable restorations recently, but my observation has been that, in the past few years, much has been said for removable work and little in favor of fixed work. The tendency, at the present time, seems to be toward a more normal and conservative course. Many dentists are now less radical, having concluded that no one method of supplying missing teeth will meet all cases and that there is a place and an important one in dentistry for fixed bridgework. Dr. Klaffenbach speaks of the agitation in this department of dentistry and the resultant theories and practices propounded, which have served as searchlights, casting their light into dark places; but, as I see it, the one real searchlight and the real cause for the agitation and theories propounded has been and is the roentgen ray. The revelations of the roentgen ray are many and of such a nature that they cannot be disregarded; hence, the upheaval, agitation, discussions and proposals pro and con; and I believe that this applies especially to fixed bridgework, for the reason that, on account of the excessive abuse of the principles underlying fixed bridgework, there were and are more dark places to be revealed than in any other branch of dentistry. The roentgen ray has been the means of bringing about a new era in fixed bridgework, and unless dentists are aware of this and realize just what the roentgen ray has revealed, in order that the abuses may be done away with and corrected, it would be better to confine the restoration of missing teeth to other methods. Let us now review briefly the roentgen-ray findings relative to this subject. These, as enumerated, I believe constitute the underlying principles of crowns and fixed bridgework: (1) correct diagnosis; (2) conservation of pulps; (3) conservation of tooth structure when dealing with vital teeth; (4) avoidance of irritation of the soft tissues; (5) obtaining correct and balanced occlusion; (6) the proper types and forms of pontics, and (7) proper contact points. The roentgen ray has revealed to us the bad conditions resulting from the abuse of the seven factors above enumerated and before the use of the ray, we were practically ignorant of the seriousness of these abuses; hence, I repeat that the ray has revolutionized fixed bridgework. Dr. Klaffenbach tells us that it is self-evident that artificial restorations of any kind are undesirable. This is true, of course, only as compared with the normal and natural conditions; but we are indeed fortunate in having a means of correcting abnormal conditions and, if properly employed and applied, artificial restorations can be made most gratifying. The statement that the edentulous spaces should not remain too long without some type of restoration is well taken, since many retrogressive changes take place in the case of neglect. We are told that "the chief object in bridge restorations should be to restore and maintain function and unity in the human mechanism of mastication," and this is correct; then, in the following paragraph, that "in order to do this, we must be able to make an intelligent and correct diagnosis; be able to differentiate between physiologic and pathologic tissues; have a scientific knowledge of the mechanical, physiologic, anatomic and hygienic requirements; and, lastly, be able to plan, construct and restore the broken units artfully and have them meet the requirements." I wish especially to congratulate Dr. Klaffenbach on the contents of this paragraph. In it, he told us the entire story. It simply remains for us to study the advice given, assimilate it and put it into practice; then, the condemnation of fixed bridgework will end. The casting process referred to has indeed proved a boon to the dentist in the construction of all metal structures, simplifying the construction in many cases as well as making it possible to construct abutment pieces for vital teeth requiring the minimum of tooth grinding and destruction. I do not agree with the statement concerning full shell crowns. Several years of clinical experience has convinced me that a full shell crown, correctly adapted and used on the short and straight variety of molars and bicuspids does not jeopardize the vitality of the pulps, and it makes the best and most nearly permanent type of abutment piece in some cases; such as small chalky and decayed teeth and teeth which have a tendency to decay readily. On the more bell-shaped teeth and teeth of sounder structure, the use of the full shell crown is contraindicated. In speaking of the fixation of abutment teeth, Dr. Klaffenbach says: "The great destructive factor in restorations of this kind is abnormal stress or traumatic occlusion." May I add to this another factor which is equally destructive, the irritation of the gingival soft tissues by badly adapted abutment pieces; the initial irritation finally resulting in infection

and deep seated pathologic conditions. Regarding the fixation of abutment teeth, the claim, as Dr. Klaffenbach has suggested, is made that a fixed bridge possessing two or more abutment pieces and soldered in one rigid piece should not be used, for the reason that it interferes with the individual movement of the abutment teeth, resulting in injury to these teeth and their investing tissues. I believe that a fixed bridge of this type, of reasonable size, properly constructed and adapted, is often necessary, for the reason that it supports the abutment teeth that have lost their natural support, and thus prevents too much movement. The injury to abutment teeth that is attributed to fixation is more often caused by badly adapted abutment pieces, causing irritation of the gingival soft tissues, by abnormal and traumatic occlusion. A correctly adapted fixed bridge, even where more than two abutment teeth are included in one solid structure, will not interfere with individual movement to an injurious degree. There is no such thing as absolute fixation of abutment teeth with a fixed bridge which is correctly constructed and adapted. Stress-breakers may often be used to advantage, but, in their use, we must be careful not to throw too much stress upon one tooth which has lost its natural support and requires the retention and support of a bridge of two abutment pieces and soldered to both. We are told, and it is true, that anterior and posterior teeth function differently, but this does not prevent combining them in a fixed bridge of two abutments, and oftentimes three, soldered in one rigid piece, provided the fundamentals of correct occlusion and nonirritation are carefully observed. This combination is, of course, not always necessary, but it is allowable and advisable in many cases where the abutment teeth require support against too much movement. There is no doubt that the teeth and surrounding tissues which are in a healthy condition accommodate themselves to reasonable additional stress of a fixed bridge. Also, as has been suggested by Dr. Klaffenbach, automatically and unconsciously a wearer of a fixed bridge will not exert so much masticating stress on, say, a four-tooth bridge supported by two abutment teeth as on the four normal teeth, although the stress is sufficient for all practical purposes, so that, in reality, the two teeth are not called on to do the work of four. Another factor which enters into a properly adapted fixed bridge and is an argument against overdoing the use of the stress-breakers is that, in a bridge soldered fixedly at both ends, we have added strength and stability on account of this unity, and this factor explains why two abutment teeth will successfully carry a four-tooth, and oftentimes a five-tooth, fixed bridge. Some of our removable-bridge enthusiasts make the claim that the soft tissues and the alveolar process of an edentulous space require the saddle of a removable structure in order that they may be kept in a healthy condition. I do not believe this. Some of our fixed-bridge enthusiasts claim that a saddle of a removable bridge cannot be adapted so that it will not be an irritant to the soft tissues. I do not believe this. There is a large field of usefulness for both the fixed and removable types of bridges, and it simply remains for the dentist to make the correct diagnosis and then correctly construct and adapt the structure according to modern requirements.

COMPARATIVE ADVANTAGES OF THE RIBBON ARCH*

By OROSMAN LOPEZ, D.D.S., Havana, Cuba

MY position as a foreign member of this Congress with a limited knowledge of the English language, prevents me from attempting to go very far into the subject at issue. Nevertheless, the international character of this gathering, it seems to me, is enough to justify my intention of placing a small, perhaps sterile, seed in the ever promising and immensely complicated field of orthodontia.

Before going into a consideration of the comparative advantages of the ribbon arch and advocating its adoption as one of the most effective corrective mechanisms at the present time, I want to say emphatically that, in such an attempt, I do not intend to disregard in the slightest degree such appliances as those invented, evolved and improved by the man, living at present in Pasadena, who took orthodontia from the darkness, uplifted it and introduced it to the dental world, not as a trade, as it had been generally considered up to that date, and as is at present considered by some, but as a science the fundamental principles of which are to be found in embryology, history, anatomy, physiology, mechanics and art.

The impetus given by this man, whose inventive genius has spread all over the world in comparatively few years, had as the beginning only the success and reputation attained by a group of general practitioners, some of them present at this moment (I am not one of them), who traveled to St. Louis and New London cheerfully and enthusiastically to take the annual course in modern orthodontia. No wonder, then, that under the circumstances, I, who at different times have applied for advice to several of the above mentioned orthodontists, mostly because I knew them to be Angle school graduates of orthodontia, take the liberty of addressing this assembly in an attempt to express my gratitude to others, and to stimulate the skeptical to try faithfully and repeatedly the orthodontic mechanisms under consideration.

In 1914, after several attempts at correcting cases of malocclusion by the usual methods and employing the suggestions of such writers as had published textbooks on orthodontia at the time, that is to say, Kinsley, Guilford, Jackson, Case and Angle, and whatever works I came across I tried to approach a number of practitioners, some of whom were and some of whom were not graduates of the Angle school, with a view to solving the everincreasing failures that presented themselves. After meeting Dr. Angle, I was invited

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to attend the meeting of the Alumni Society of the Angle School of Orthodontia, held in New London, Conn. At this meeting, the ribbon arch mechanism was introduced to the dental profession at large. The inventor was attempting to displace the pin and tube appliance, a previous invention of his. The pin and tube appliance, to the best of my knowledge, is no longer manufactured by the firm who has the patent and at present is replaced altogether by the ribbon arch.

I do not contend, of course, that the whole appliance, with its delicate tubes, cannot be made by the expert orthodontist. My contention is that the principle involved in the ribbon arch is to move teeth in malocclusion, taking advantage of a flattened arch that engages in brackets soldered to incisors, cuspids and bicuspid bands, and which are soldered to places in the bands of a greater thickness than the rest of its length. Also, the sheath for anchorage molars is provided with a flattened horizontal cavity to accommodate the flattened wire with the greatest precision. The fundamental principle is based on the possibility of moving the apices of roots independently of the crowns of teeth; also that the crowns can be moved labially, buccally or lingually, mesially or distally without affecting to any great extent the relative position of the apices. That the frequent anomalies consisting of infraclusion of upper cuspids as well as the supraclusion of lower incisors can be equally corrected with the ribbon arch by intelligently bending it. Every experienced orthodontist knows that the tendency of lower incisors in cases corresponding to Class 2, Division 1, is to tip labially if the labial arch is round, when the intermaxillary splint is applied. Such a tendency, to my knowledge, would be controlled to perfection by the proper application of the ribbon arch and the torque or twisting lingually of the arch, which has previously been lined well below the margin of the gum.

Equally important, to my mind, is the treatment to be given to upper incisors in cases corresponding to Class 2, Division 1, which is characterized, among other peculiarities, by frequent supraclusion of the incisors. I have often seen hooks soldered to lingual arches, the former resting against the cutting edges of the incisors. I have always wondered about the natural contact of the labial aspect of the lower incisors against the lingual aspect of the corresponding uppers. Here, again, the ribbon arch is indicated to depress the incisors apically as well as move them lingually in supraclusion, and labioversion. A comparison of the action of any round labial arch with the ribbon arch as to its dynamic force reveals the fact that the former can depress the incisors, but that, as to their moving lingually, it has to depend entirely on the intermaxillary pressure, which is not very desirable—for, in the case of the ribbon arch, the intermaxillary splints are assisted by the torque or twist of the correcting wire.

Now we come to study, at least superficially, the technic of cleats. Whether we use the ribbon arch proper or the ribbon arch modified by the use of a front section of twenty-thousandths round wire to correct the torsoclusion complicated by linguoclusion of lower incisors, as suggested by Dr. Ketcham and Dr. Hawley and perhaps others, if we do not use cleats properly we may be disappointed. The cleats have been added to this mechanism to fill a long-felt want and particularly to produce

the bodily movement of the teeth affected. The objection that they are exceedingly difficult to handle should not be taken into account, as any man doing modern orthodontic work ought to know how to solder these delicate parts, which are most effective and indispensable.

Of late, I have found out that I could not do the best work without cleats, spurs and hooks which are indispensable to the perfect working of the ribbon arch. These parts are described in the literature on the subject.

The physical condition of the ribbon arch is essential to success. The condition of the alloy of which this flattened wire is made constitutes one of the most important of its properties, yet has been at times considered an objection to its use, and the round front section has been suggested. It seems to me that if the orthodontists follow to the letter the technic advised by writers on the subject, there will be no reason to discard the kind of appliance. I use the ribbon arch in its entirety from the beginning of treatment and all the seeming difficulties are easily overcome by the technic adopted. Gold and its alloys soften by heating to redness and plunging in alcohol, which is preferable to water for this purpose.

Briefly stated, my technic is as follows. I shape the molar bands by the direct method and always in precious metal. When the bands are fitted and properly burnished to conform with accuracy to the shape of the molars and the buccal tubes have been soldered to them, I secure an impression in soluble plaster, never in modeling compound, of the case and make a cast in artificial stone, gray or white. On this stone model, with bands *in situ*, I adapt my arch by passing its ends through the curved sheath, and, by the use of six piano-wire staples, I hold the arch close to the wire. Now I gently direct the flame of my blowpipe, be it Grimberg, Young or any other, going over the length of the wire to perfect the adaptation to the cast. I next plunge the cast in water, and the result is an arch fitting the model with perfect accuracy, which, after being properly annealed, is ready to be adapted to the bands on the teeth without the slightest probability of causing pain to the patient, as the arch at this first stage of the correction is soft.

DISCUSSION

Robert H. W. Strang, Bridgeport, Conn.: Dr. Lopez shows a knowledge of the virtues of the ribbon arch mechanism, which is most commendable, and this certainly should stimulate the interest of the orthodontists of our own country in this wonderful appliance. There are but two statements in his paper with which I would take issue. The first concerns the use of the ribbon arch appliance as a retainer. The problems of treatment and retention are quite different. In the former procedure, the operator wishes complete force control over the teeth to be moved, and the ribbon arch mechanism is ideal for this purpose. When tooth movement has been completed, the teeth should be free to react to the normal forces of occlusion, in order that they may stabilize themselves under such guidance; hence, the only mechanical pressure that should be upon them during the retention period is that minimum amount that will prevent a return to the former positions of malocclusion. The other point that I would discuss concerns the primary adjustment of the arch. Dr. Lopez's technic will undoubtedly result in a beautiful adaptation of the arch to the brackets, but it seems too complicated. By painstaking study, one can so familiarize himself with the ribbon arch mechanics as to be able to make a reasonably passive adjustment of the arch while working directly in the mouth of the patient. This, of course, saves considerable time and eliminates a technical procedure.

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Editorial

CONTENTION OVER PROFESSIONAL FEES

We hear much comment about contentions which arise in connection with dental fees. In groups at meetings and at all gatherings where dentists congregate, this subject of fees appears to be a prolific topic of conversation. It would seem quite natural, of course, that a question which has to do with the material welfare of the practitioner should command a reasonable amount of his attention, but it is altogether inappropriate that, in a professional pursuit the consideration of money should be made the paramount issue, and it is carried beyond the bounds of propriety and becomes the essence of incongruity when a professional man permits himself to indulge in frequent contentions over fees.

Something is wrong in the conduct of a professional practice in which bickering over fees is the rule instead of the exception; in fact, in which bickering is permitted to enter at all. It is of course understood that honest differences of opinion may arise between patient and practitioner, but if the practice is estab-

lished on the foundation of equity and justice, all such differences can be adjusted without contention. Nothing is more demoralizing in professional life than inharmony and misunderstanding, and nothing is more disastrous than court proceedings to force a claim. It is seldom that anything good ever comes from a case in court between the professional man and his patient. This has so frequently been demonstrated that, in an honest effort to avoid court proceedings, the American Society of Orthodontists at a recent meeting unanimously passed the following resolution:

Be It Resolved: That it is recommended that each member of the American Society of Orthodontists insert in his written contracts or in his letters confirming an understanding reached with his patient the following arbitration clause or one similar:

"In the interest of the retention of a friendly professional relationship, it is agreed that any dispute or claim arising out of or in connection with the orthodontic services referred to herein shall be settled by arbitration under the rules of the American Arbitration Association."

No doubt, in this resolution a laudable attempt was made to avoid trouble, but we must express a mild amazement that a body of professional men and women of the high character represented in this splendid organization should ever have found it in their hearts to pass a resolution such as that, and we cannot help wondering how many of the members will literally follow the dictates of the resolution in their relationship with patients.

Does not such an arbitration clause carry with it the tacit acknowledgment that there is danger of dispute between the patient and the practitioner? Would not the average patient, if asked to agree to such a clause, quite naturally infer that the genesis for such an agreement lay in a series of previous disagreements, and that it was the rule rather than the exception for disputes to occur?

With the general principle of arbitration, we have the fullest sympathy. We believe it to be better in every instance to abritrate a dispute than to take it to court; but we cannot help raising the question as to why there should be so many disputes in professional practice? It seems to us wholly without the pale of professional respectability and dignity to be always contending

with patients over fees, or in fact contending over anything. Has our professional status sunk so low that we are obliged to arm ourselves against disputes by an agreement of arbitration before we dispense service? Can it not be taken for granted that there is enough honor left among dentists to so deal with people that there shall be no basis for disputes and little likelihood of any? And is it not possible to imagine that, in the few cases of unlooked-for disputes which may arise in any practice, there is enough force of character and fair dealing inherent in the professional man that he can adjust the matter without appeal to outside aid? The whole plan has something akin to the idea of preventing war by building up huge armaments, and the mental attitude of such a procedure holds within it the germ of trouble.

The best traditions of dentistry were never built on any such conception of man's relationship with his fellowman. The whole stable structure of professional comity and good will—the delightful confidence reposed by the average patient in his professional advisor, the warm friendship which so frequently grows up between patient and practitioner—was never evolved by an agreement to arbitrate disputes. The very suspicion that disputes may arise is fatal to the fullest confidence between man and man, and suspicion has no place in any professional relationship.

When disputes over fees arise, they are usually due to one of two things: either the patient has not been educated to the value of the service, or that the fees are unreasonable. In neither case will an agreement to arbitrate solve the problem: it goes deeper than that—it becomes a matter of change of conviction.

The ideal dental practice is the one in which patients come year after year with the fullest confidence, and place their dental problems in the keeping of the practitioner, assured not only of his best endeavor but also of his equitable dealing, and never raising a question of fees. Such a practice can be built only on loyalty of service, rock-ribbed honesty and equity of dealing. It can never be built on an agreement to arbitrate disputes.

THE TEN COMMANDMENTS

In the May, 1927 issue of *Hygeia*, there appeared an article "Guiding Points in Choosing a Doctor," and the various qualifications therein outlined for the ideal physician seemed so fundamentally sound and sensible that they called forth a train of thought as to what might be expected of the ideal dentist. Of course, in choosing a dentist the average patient relies almost solely on the recommendation of friends, and this is much wiser than to be enticed by glaring public advertisements, which may or may not be misleading, but usually are. In setting up a standard for the ideal dentist and expressing it in the briefest space, recourse is hereby had to a paraphrase of the time-honored ten commandments. As a code for professional conduct, it is doubtless inadequate, but it at least may be made the basis of a more comprehensive one by an abler writer.

1. Thou shalt be clean in mind and in body; in thy office, in thy home, and in all public places.

2. Thou shalt not speak ill of thy fellow practitioner, nor bear false witness against him.

3. Thou shalt not despise the modest and retiring member of the profession, but thou shalt acclaim the virtues of thy colleagues.

4. Thou shalt not commit the common sin of deceit or dissembling; thou shalt not worship false gods nor follow foolish fads.

5. Thou shalt uphold the honor and dignity of dentistry, and do nothing whereby it may be defiled.

6. Thou shalt not betray a trust reposed in thee by thy patient, or by the patient of another, or by thy fellow practitioner; thou shalt hold inviolate any confidences committed to thy care.

7. Thou shalt consider thy patient before thyself, willingly sacrificing thine own comfort for the well-being of others.

8. Thou shalt not withhold professional succor or advice from the poor and needy, but shalt always relieve suffering wheresoever it may be found.

9. Thou shalt aim to excel in all needful advances in thy calling, by attending conferences, by seeking counsel of thy fellows, and by constant and faithful study.

10. Thou shalt not be envious or narrow, but open-minded to the light whencesoever it may come; thus may thy days be long and happy in the land where thou liveth.

We know how futile it is to attempt to reform the world by a written code, and yet without some guide or formula we

would be prone to drift idly over the fateful waters of laxity and indifference. We are so very weak, so inclined to lapse from our good resolves, so likely to fall short of our highest ideals, that we need a constant reminder to point the way and keep us in the beaten path of rectitude and right living.

Our dental code of ethics is merely a systematized attempt to do this, to formulate a tangible set of rules for the guidance of those who are desirous of doing right, and a mandate for those whose inclination is to do wrong. Without the code, the profession would never have achieved the status it has in the eyes of the world, and there never would have developed the distinction that exists today between the profession and a trade. The more we safeguard our young men as they enter the profession, the better it will be for the future of dentistry. As has so frequently been stated, they are to make the bone and sinew of the profession in the days to come, and all we can do to point the way to higher aspirations is none too much—even to the extent of asking them to read and remember the ten commandments.

WILLIAM G. MASON
(1866-1927)

William G. Mason was born in Wrightsville, Ga., Dec. 13, 1866, and died suddenly of angina pectoris in his home, Tampa, Fla., June 5, 1927.

Dr. Mason was married to Miss Nannie C. White, of Plant City, Fla., in 1906. He is survived by his widow, two sons, William G. Jr., and Joseph, and one daughter, Ruth.

Dr. Mason was of English descent. His earliest known ancestors came to America in colonial times and settled in Virginia. He was a direct lineal descendant from the distinguished George Mason of Revolutionary fame, who served on the committee which formulated the Constitution of the United States. This family furnished many distinguished men to the republic. Charles Mason, with Jeremiah Dixon, established the boundary line between Maryland and Pennsylvania, which afterward became the historical Mason and Dixon line. Another member of this family was the last territorial governor of Michigan, and when this territory was admitted to the Union, he was elected first governor of the state. John Young Mason, prominent in public life for a generation, and who died in 1859, while minister to France, was a member of this family. Another well known historical member of the Mason family, Senator James M. Mason, of Virginia, was the hero in the famous international complication known as the

WILLIAM G. MASON
(1866-1927)

"Mason and Slidel Affair." Another of the distinguished family died a brigadier general in the United States Army, in 1853. Dr. Mason's father was Judge Madison H. Mason, a native of Georgia, and a planter by occupation.

William G. Mason was reared on his father's farm near Wrightsville, Ga., and was educated at the Nannie Lou Worthen Institute of that place, now known as Worthen College. When he reached the age of 21, he engaged in teaching, a vocation which he followed for three years, after which he entered the Southern Dental College of Atlanta, Ga., from which he graduated in 1892. He first located in Sanford, Fla., for the practice of his profession, but removed to Tampa in 1895, where he was engaged in active practice until his death.

Rarely is one found who has achieved more eminent success in the practice of his profession or who was more dearly beloved by his co-workers and by the public than was Dr. Mason. As a member of the Florida State Dental Society, no man in the state ranked higher. The best of his life was devoted to the development of fraternal unity, higher standards and better health service throughout the dental profession. He literally died in the harness, as he attended the meeting of the West Coast Dental Society at Lake Wales, Fla., June 3-4, at which time he gave a clinic. His passing so suddenly the day following was a deep shock to his family and friends.

Dr. Mason was for twenty-one years a member of the Board of Dental Examiners of Florida and served as both president and secretary of the board. He had been a member of the American Dental Association since it was merged with the Southern Dental Association in 1897, and served as corresponding secretary of the southern branch of this Association from 1908 to 1911.

It was my happy privilege to know Dr. Mason intimately during his entire professional life. His interest in the young professional man rarely has been excelled. He never was too busy to stop to extend words of encouragement or quietly to perform deeds of kindness, of which the world knew nothing, and which often were an inspiration to younger and less fortunate practitioners.

Dr. Mason was active in all civic developments. He served as alderman of Tampa a number of years, and was deeply interested in and contributed liberally to the Associated Charities, Welfare League, Red Cross, Y. M. C. A., etc. He was identified with the Methodist Church, was a Thirty-Second Degree Mason, Knight Templar and member of the Shrine; a Knight of Pythias, a member of the Lions Club and of the Brotherhood Protective Order of Elks. He was a member of Theta Theta chapter, Delta Sigma Delta fraternity, and Lambda chapter, Omicron Kappa Upsilon fraternity (Atlanta Southern Dental College).

The dental profession has, in his death, sustained an irreparable loss.

S. W. FOSTER.

DR. LOUIS MEISBURGER

Just as we go to press we learn with regret of the sudden death of Dr. Louis Meisburger of Buffalo, N. Y., on August 10th. Further particulars will be given in our next issue.

DEPARTMENT OF DENTAL HEALTH EDUCATION

THE INFLUENCE OF MASTICATION AND OF THE FIRST PERMANENT MOLAR ON THE ESTHETICS OF THE FACE*

By A. COELHO e SOUSA, Rio de Janeiro, Brazil

THE conditions I am presenting apply to Latin America in general and especially to Brazil.

Slow and thorough mastication is an essential to proper alimentary hygiene and the first step in a well started process of digestion. In addition, according to the opinion of leading physiologists, this muscular action accelerates the heart action, and, consequently, the circulation, transmitting to the oral tissues the vital stimulus that circulatory excitation gives to the muscles, glands, bone and teeth.

Modern society ignores completely this important recommendation as to the first step in the digestive process. Feverish activity possesses the population of the larger centers, and what is happening is the exact opposite to the first rule of alimentary hygiene—we all masticate imperfectly and too quickly.

The transgression of the rule not only overburdens the stomach in its important function, but also reduces the action of the factors governing the esthetic and physiognomic equilibrium of the face. The organ most affected by insufficient mastication is the nose, whose structure will be modified by the displacement of the nasal bones.

The deformation of the nasal skeleton bears a direct relation to the formation of the postnasal adenoid tissue by limiting the respiratory function, which from nasal becomes almost entirely buccal.

This condition brings about a compression of the delicate maxillary bones in a child, reflecting on the palatine arch, which will assume a high contracted shape, with a corresponding protrusion of the bony portion of the nose.

In this movement of the nasal bones, part of the action may be attributed to faulty mastication, the pressure of the muscles of mastication in conjunction with the action of the pterygoids, due to their intimate relation with the nasal pharynx.

Owing to the insertion of the pterygoids in the processes of the same name, a relation is created of such a nature that growth of adenoid and

*Read before the Section on Mouth Hygiene, Preventive Dentistry and Public Health at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

polypus tissue is stimulated when mastication is improperly accomplished. When the external pterygoids contract, they exert a lateral pressure on the pterygoid processes and on the posterior part of the maxillaries, establishing a normal opening of the back portion of the nasal fauces.

Also, it cannot be denied that mastication accelerates the blood circulation in the muscles that enter into play during this physiologic process, and that, from this circulatory excitation, the adjoining organs, such as the salivary glands, tonsils and fauces, are greatly stimulated.

Hence, thorough mastication practically from early childhood contributes to the development of the face and stimulates the functions of the oral organs, avoiding the conditions that result in a sequelae of lesions of lymphatic origin, such as adenoids.

This fact is based on the physiologic principle that the volume of a bone is in part influenced by the group of muscles that are attached to it.

The modern child, accustomed to soft foods, is late in developing adequate musculatory exercise, and when the coarser foods begin to form a part of the diet, decay of the teeth has usually begun. From now on, in order to avoid pain, the child will not chew properly and the bolus delivered to the stomach will be deficiently formed.

Two evils result from this: excessive work on the part of the stomach, and insufficient muscular exercise in mastication.

The nature of man's diet has influenced, with the passing of the years, the teeth and jaw bones. Such modifications consequently affect the lines of the face. Also, in the evolution of the human race, a pronounced modification has been effected on the face and dental arches through the intellectual development of the cranium.

Coincident with the intellectual evolution, the alimentary regimen has also been modified.

In anthropology, human evolution has been classified from the alimentary standpoint into five phases: (1) anthropoid period; (2) raw food period; (3) cooked food period—preagricultural; (4) primitive agricultural period.

The first phase, to which our most remote ancestors belong, according to Darwin, follows a diet consisting of all that the present-day anthropoids consume in their native habitat: the plants, which consisted principally of raw uncultivated vegetables and fruits with hard skins, requiring an effort to masticate. For this reason, the jaws were heavy, the teeth large and the alveolar processes elongated.

In the second period, our ancestors acquired a more human appearance. Meats and vegetables were eaten raw. The jaws changed slightly in their form, and this modification was assisted by the expansion of the cranium, caused by mental development.

In the third period, the food was cooked and therefore the texture of the vegetables was softened and offered less resistance to mastication. It is in this phase that the jaws and teeth showed the most marked modification; however, they still retained several primitive characteristics.

Sharpened instruments for cutting were still unknown to the human race; therefore, foodstuffs, such as meat, were torn with the teeth, and vegetables,

although cooked, were hard and coarse, requiring energetic trituration.

The inferior races, such as the bushmen of Australia, the African Negro and the Eskimos, give us an example of this evolution; for, in these races, the jaw follows approximately the shape of a fan, being similar to that of the anthropoids. They have molars with five cusps, and although the third molars are developed, they show a tendency to become atrophied.

The modification in the fourth and fifth phases becomes more noticeable after the human being, having reached the agricultural period, perfected the culture of vegetables.

The present-day tendency is to facilitate mastication by the production of softer foodstuffs. Owing to this fact, we find a reduction in the size of the jaws and teeth, with an accompanying evolution in cusp formation, shown in the reduction of the number of cusps.

Only the first lower molars still retain the five cusps. On all the remaining molars, they have been reduced to four, with a visible atrophy of the fourth cusp of the upper molars. The third molar is becoming smaller every day, and the tendency is for it to disappear from the human dental arch. The cuspid has altered noticeably in shape as well as in function. The lateral incisors become atrophied and, in many instances, are lacking. In a few cases, they revert to the primitive conical shape.

In conclusion, it is a verified fact that, from the beginning of the anthropoid period to the present day, the evolution of the human species has changed, bringing about a modification in the volume and form of the jaws and teeth. This is founded on the following facts: 1. Teeth are no longer used as weapons of attack or defense. 2. The size and capacity of the cranium have increased. 3. There has been progressive modification of the diet, allowing less work to be performed by the jaws and teeth.

In order to stem the growing tide of degeneration, it is necessary to establish an intensive propaganda for better mastication; for buccal and alimentary hygiene, and for better care in the conservation of the dental structure of the child, and, for that matter, of the adult as well.

Thus, we shall also avoid the premature loss of teeth, which obviously, without its being felt, has a distinct effect on the modification of the facial lines. Modern orthodontia is a factor of great merit in its relation to facial esthetics, because it condemns the practice of extracting teeth to overcome crowding due to lack of space. It is a campaign for facial beauty. But in opposition to this intelligent effort on the part of the dentists, there is the carelessness on the part of the individual in his acceptance of the principles of dental hygiene and, in particular, in connection with the first dentition.

The first permanent molar suffers the most because of this carelessness, and when it begins to decay, the deciduous molars are more or less affected.

Only intensive propaganda advocating the treatment of children's teeth, beginning inspection at the age of 3, will assure the conservation of the deciduous teeth and, consequently, of the first molar. This is essential for the full and thorough act of mastication and for the equilibrium of facial esthetics.

Of all the permanent teeth, the first

molar without a doubt is the most vulnerable, principally the lower. It becomes carious first and with such frequency that Andrieu, in his paper before the Ninth Medical International Congress in 1887, defended the extraction of the four first molars as the easiest way to correct defective articulation. This is absurd and improper, but it is quite a different question if caries has resulted in pulp infection before the child is 10 years old. In this instance, the molar should be extracted. In Latin America this doctrine is in controversy.

G. V. Black argued for the extraction of all four first molars even if only one of the number was carious to the point of pulp involvement. But, at the same time, he added that it would be a difficult matter to find a dentist disposed to take such radical steps. He suggested the extraction of the antagonistic molar only.

My observations of a few years in Brazil have convinced me that it is necessary to extract the first molar, when affected, until the age of 9 years, but there is no necessity for extracting the antagonizing tooth.

To facilitate discussion, I propose the following questions, which I have answered in accordance with my views:

1. Is it advisable to extract the first molar when the pulp chamber is invaded by decay?

Yes, because the extraction will leave a space which later will be filled by the second molar, except in the case mentioned under the fourth question.

2. What are the age limits at which this extraction should be done?

As it is probable that the decay will not reach the pulp chamber before the eighth year of age, it is only after this age that the probability of an infection of the pulp takes place. As to the maximum limit, there is a diversity of opinion. Some maintain that the extraction of the tooth may be effected until just before the eruption of the second molar. From personal observation, I have concluded that it is possible for the space to be closed by the second molar when extraction is done near the time of the latter's eruption. But it is a fact that there will be a tendency for this space not to be filled, and for an anterior inclination to develop proportional to the lateness in which the operation is effected. Hence, the maximum limit is 10 years of age.

3. Is it advisable to adopt a prophylactic or preventive filling of the first molar?

In Latin America, and especially in Brazil, it is the exception to find a set of teeth with a first molar intact or present at all. Hence, the preventive filling, well done, will be of advantage.

4. What is the cause of the rotation of the bicuspids when the first molar is extracted?

It appears to me that this rotation is due to the premature loss of the deciduous teeth rather than to the extraction of the first molar. I can affirm that, in Brazil, more than one-half the children lose the deciduous molars more than two years previous to their substitution by the bicuspids. In such cases, it is advisable not to extract the first molar even though the pulp is affected, but to fill it in accordance with the proper technic, until the period of the eruption of the biscupids, which in Brazil happens at about 11 years of age, on the average.

5. Will the extraction of the first molar during the eighth or ninth year have any effect on the complete eruption of the bicuspids?

I believe not, but it may delay complete eruption, while the eruption of the other teeth does not contribute to raising the articulation.

6. Will the extraction of the first molar before the eighth year cause any prognathism?

I believe that this extraction has not the least effect on this anomaly of the mandible and that the cases shown by Jose Sanna in the Second Latin American Dental Congress are cases of congenital prognathism, in which the extraction of the first molar had not the least influence on such typical anomalies.

Filling the first molar when the child is 10 or 12 years of age, after pulpectomy, does not extend the life of the tooth beyond the twenty-fifth year. I propose the application of orthodontia in cases of rotation or other irregularities when the first molar is extracted before the age of 10 years.

REPORT OF THE COMMITTEE ON DENTAL EDUCATIONAL BULLETINS OF THE AMERICAN ACADEMY OF PERIODONTOLOGY*

THE Committee submits herewith a dental educational bulletin under the title "The Promotion of Health in the Mouth."

Although the first manuscript for this bulletin was prepared prior to this year, the Committee has made an effort during the past year to perfect its contents, and now submits it for the Academy's consideration.

The approval and publication of this bulletin are recommended.

The Committee has been requested several times by the Director of Dental Health Education of the American Dental Association to prepare a bulletin descriptive of an approved method of brushing the teeth and gums which could be used as a standard for teaching school children. Such a bulletin was also prepared by a member of the Committee (Dr. Leonard), even though the Committee itself did not seem to believe that this was the way for it to meet the request made.

A Committee member (Dr. Spalding) has suggested that a bulletin setting forth the fundamental principles of tooth brushing and gum massaging would be far more useful to the layman, and more in keeping with the Academy's views than any written description of a particular method. Therefore, it is recommended that the publication of the accompanying bulletin on "Home Care of the Mouth" be deferred until the foregoing suggestion has had further consideration by the 1926-1927 Committee, and the advisability of replacing this bulletin by the proposed one is determined.

The Committee begs to submit the following suggestions for the work of the Committee next year, namely:

*Read before the American Academy of Periodontology, Philadelphia, Pa., Aug. 20, 1926.

1. The preparation of a bulletin on the principles to be observed in the proper home care of the mouth.

2. The preparation of a bulletin on foods and nutrition as related to the hygiene of the mouth. This would be a companion bulletin to the one entitled "The Promotion of Health in the Mouth." Members of the Committee think that specific and detailed information on this subject would be of great value to those who are providing the meals for the family.

Summary of recommendations and suggestions:

1. Recommended that the bulletin entitled, "The Promotion of Health in the Mouth" be accepted and ordered published.

2. Suggested that publication of the bulletin entitled "Home Care of the Mouth" be deferred until the incoming Committee has considered the advisability of replacing it with one setting forth the principles to be observed in the proper home care of the mouth.

3. Suggested that a new bulletin giving detailed and specific information on foods and nutrition as related to the hygiene of the mouth be prepared.

Respectfully submitted,

WILLIAM A. JAQUETTE
HAROLD J. LEONARD
E. MELVILLE QUINBY
CARLOS H. SCHOTT
C. ALVIN SNELL
GRACE ROGERS SPALDING
GILLETTE HAYDEN, *Chairman*

THE PROMOTION OF HEALTH IN THE MOUTH*

(Compiled by The American Academy of Periodontology, 1926)

It is the object of this bulletin to show how by correct diet, correct use of the teeth and good methods of cleaning them, the health of the mouth and of the body may be promoted.

CORRECT EATING

There is an old saying that "we dig our graves with our teeth," and the adage holds good today; for the mouth and teeth are an intimate part of the body as a whole and what affects one, affects the other, also. Early symptoms of disease caused by deficiencies or error in the diet are frequently found in or around the teeth, and it is undoubtedly true that faults in our eating have much to do with the two diseases commonly known as decay of the teeth and pyorrhea.

In any effort to guard against these diseases and maintain a healthy mouth, one of the first essentials is correct diet.

PROPER DIET

By proper diet, we mean a diet that contains correct amounts of the food elements necessary for health and for growth. These are: protein, carbohydrate, fat, the vitamins, minerals or inorganic matter, indigestible bulk and water.

*Bulletin No. 5. This is one of a series on the teeth and their care prepared for the information of the public.

PROTEIN

Protein is the food element which is necessary for the building of the muscles and organs of the body. For the adult person, a small amount is all that is necessary to replace the losses that these tissues sustain from the wear and tear of every day life. But this small amount of protein must be of good quality or the body will lack the element it needs. For growing children, larger amounts of protein are necessary because new tissue is being built as well. The best quality of protein is found in milk, eggs and meat, and when these three foods are included in the diet, there is little danger of a protein deficiency.

Foods Which Contain Large Amounts of Protein.—These foods are eggs, milk, meat, fish, cheese, peas, beans (dry), peanuts and other nuts and cereals (whole grain).

Milk should be used with cereals to supplement the incomplete protein of the grains.

In the average American family, there is danger of the diet's containing too much protein rather than too little, especially among adult persons not engaged in active, physical work in the open. The excess places an added load on the kidneys, or is retained and is a menace to health.

CARBOHYDRATES

Carbohydrate (sugars and starches) furnishes the greatest part of our food. It is the chief and the cheapest source of energy.

Foods Which Contain Carbohydrate in Large Quantities.—These foods are: sugar, potatoes (white and sweet), cereals (and cereal products), vegetables (dry beans and peas) and bananas. Sugar is pure carbohydrate.

The different grains, as a result of our modern methods of milling and refining, are reduced to almost pure carbohydrate (starch), with a little protein of poor quality. Since this is so, there is serious danger that a modern dietary will include an excess of carbohydrate because our tendency is to let these foods form the bulk of the daily supply. Sugar and starch are completely consumed or burned by the body to give us energy. Carbohydrates are stored in the body in the form of a sugar, called glycogen. The excess may be stored as fat in the body tissues.

How the Mouth Helps to Take Care of the Carbohydrates.—The saliva in the mouth contains a digestive juice, called ptyalin, which acts on the starches. Long chewing of the starchy foods is necessary for the easy and complete digestion of starch.

Consequences of Eating Too Much Carbohydrate.—Unless we combine a certain amount of indigestible bulk with the carbohydrates, we eat an excess of concentrated food before the appetite is satisfied. The result is that there is not enough waste material left after digestion to keep the intestine functioning normally, and intestinal fermentation, constipation and ill health follow.

Decay of the teeth and pyorrhea are believed often to be effects of such ill-health.

FAT

Fat, like carbohydrate, is converted into energy in the body. It furnishes two and a fourth times as much fuel as starch or sugar. But it is more expensive than carbohydrate and not used so much, except among the Eskimos, who live on a diet rich in fat. Some of the fats contain essential vitamins. This is particularly true of butter fat.

Consequences of Eating Too Much Fat.—The eating of too much fat results in excess of fat storage in the tissues and is heating in summer. It burdens the digestive system, and in babies, skin eruption often results.

Foods Containing Large Amounts of Fat.—These foods are: butter, cream, fat of meat, salad oils, nuts and chocolate.

VITAMINS

There are five essential vitamins, named for convenience A, B, C, D and E. They are of unknown chemical composition and are necessary as regulatory substances in the body. So essential are they that a total lack of any one of them leads finally to death, and a partial lack leads to lowered body resistance and failure to grow.

Where Vitamins Are Found.—The A vitamin occurs in: cream, butter, egg yolk, fresh green leaves, yellow corn, glandular organs, such as (1) kidney, (2) liver and (3) sweetbreads and in carrots, sweet potatoes, cheese, whole milk and cod-liver oil.

This vitamin is required for the maintenance of health and is needed especially by children to obviate susceptibility to certain infectious diseases. A disease of the eyes results from the lack of it, as does also night blindness.

The B vitamin occurs in: green leafy vegetables, tubers and root vegetables, cereal grains (whole), milk, eggs, peas, dried beans and fruits.

Vitamin B prevents beriberi, a disease of the nerves which results in paralysis.

The C vitamin occurs in: fresh raw fruits, uncooked green leaves, carrots, yellow turnips, raw cabbage, tomatoes, cooked or uncooked, and celery. Raw milk from grass-fed cows contains a certain amount.

The C vitamin is easily destroyed by cooking, except in tomatoes, in which it seems to withstand the heat if the cooking time is short. Therefore some fresh uncooked fruit or vegetable should be eaten each day.

Vitamin C is necessary for the proper growth and development of bones and teeth. It prevents scurvy, a disease the chief symptoms of which are seen in the mouth as swollen, blue, pendulous gums and loosening teeth. Infants brought up on artificial food will show scurvy in about 8 months unless the diet is carefully supplemented by orange or other fresh fruit juice, or tomato juice.

Vitamin D prevents rickets. This vitamin has not been found generally in the ordinary foods but it occurs in cod-liver oil and other fish liver oils, egg yolk and butter.

The D vitamin is necessary for the proper growth of bone and teeth in children, and for their healthful maintenance in the adult. A slight deficiency

of vitamin D is characteristic in lowered resistance to common infections, such as colds, and in decayed teeth. Exposure of the body to direct sunshine produces the same effect as eating the foods that contain this vitamin. Sunshine is a preventive of rickets, and children should be allowed to play out doors to receive its benefits. In summer, if children are clad in thin garments, bathing suits or trunks so that the skin may become gradually tanned, they will build up bodily vigor. Too long exposure to direct sunlight by either children or adults is to be avoided because of the injury that may result. The body should become accustomed to sunlight very gradually.

Vitamin E has been discovered quite recently. It has to do with reproduction. Vitamin E occurs in wheat, lettuce and lean meat.

MINERALS AND INORGANIC ELEMENTS

The chief inorganic elements likely to be deficient in the diet are calcium, phosphorus, iron and iodin. Others, while equally essential, are always present and so do not need to be considered.

Calcium.—Calcium is found most abundantly in milk, cheese and leafy vegetables. Some fruits and root vegetables contain it in good amounts. The cereal grains such as wheat and rice contain but little, especially after milling and removal of the bran and husks, and muscle meat has almost none. Hard water may contribute a little to the dietary. There are many people in America and England living on white bread, meat, potatoes, polished rice and refined sugar, with a minimum of milk, cheese, leafy vegetables and fruits; a diet in which this element is very deficient. Many common dietaries have been found to contain less than half the mineral amount necessary for a normal grown person, not to speak of the larger amount needed for growing children or for expectant, or nursing mothers. If a dietary otherwise rich in calcium is not chosen, at least a pint of milk a day is necessary for adults and a quart for growing children or for expectant or nursing mothers.

Although calcium is found in all natural foods, such as milk products, unmilled grains, leafy vegetables, fruits and even meats, excepting muscle meat, modern methods of refining and cooking often take away the calcium, so that it is lost to human diet. For example, the farm animals are fed the byproducts of white flour, polished rice, etc., which are rich in calcium and vitamins, and the housewife throws away the water in which vegetables are cooked and which contains calcium and other minerals so necessary to human health.

What Calcium Does in the Body: Calcium is the most abundant element of the teeth. Phosphorus and vitamins D and C must be present in sufficient quantities with calcium to build strong sound teeth which will be resistant to disease.

Calcium is one of the great regulators of the body. With magnesium and phosphates, it is necessary for bone and tooth formation and maintenance.

Foods rich in calcium which should be a part of every proper diet are milk and milk products (except butter), eggs, green vegetables, legumes, whole cereals, molasses and nuts.

Phosphorus.—Phosphorus is a most important element in maintaining the proper action of the blood. Phosphorus is essential for growth, for the production of bone and for the teeth. As previously stated, without the proper proportions of calcium and phosphorus, the health of the bones and teeth suffers.

Foods Rich in Phosphorus: These foods are: milk, eggs, whole grains, legumes, meat and fish, fruits, green vegetables and potatoes.

Iron and Iodin.—Iron and iodin are also necessary elements for the maintenance of health.

Best Sources of Iron: The foods furnishing iron are vegetables, fruits, milk, and eggs.

Foods Containing Iodin: The foods containing iodin are sea fish and green vegetables.

GOOD DIET

McCollum, one of the great students of nutrition, has pointed out three types of diet on which primitive man has lived and developed the most perfect physical bodies. These are milk and milk products, which make up so large a part of the diet of the nomadic tribes of Arabia and western Asia; leafy vegetables, which make up a great part of the diet of the vigorous northern Chinese, and meat, consisting mostly of the blood, bones and organs rather than the muscle meat. The last makes up the principal staple of the Eskimos and Lapps, two physically vigorous races, and was also the food of the American Indians of the plains, who were noted for their physical perfection.

On the other hand, he contrasts the results of these three types of diet with that of large masses of people today who live largely on milled flour, muscle meat, sugar, polished rice, potatoes, and canned peas and beans. He shows the physical inferiority of these people in size, physical vigor and in tendency to disease, especially dental disease. He shows that animals fed on diets such as are used by large numbers of Americans and Europeans almost invariably show similar deterioration after a time, even including decay of the teeth.

The common diet is faulty because it lacks calcium, phosphorus or iron, or regulatory foods, and vitamins. It is so soft that it is eaten rapidly with insufficient mastication and insalivation. And it is too concentrated; that is, it lacks indigestible bulk, which is necessary to dilute the food to prevent overeating and to give substance for the intestines and so prevent constipation, and is also necessary in the mouth to cleanse the teeth while masticating.

By indigestible bulk, we mean that part of the materials used for food which are not entirely digestible, such as: (1) the outer or bran coats of wheat, rice, rye, barley and corn; (2) the edible skins of fruits and vegetables; (3) the small seeds in fruits and vegetables, such as are found in berries, figs, tomatoes, and cucumbers, and (4) the frame work, or skeleton, of green leaves, vegetables, fruits and grains.

Under normal conditions, this indigestible bulk, or food residue, is necessary for the healthy functioning of the intestines. Without it, many cases of constipation result.

WATER

The human body is about two-thirds water. The average person should drink six glasses of water daily in addition to that supplied by the diet. Less is required where milk or other liquids are used freely, and less is demanded in cold weather than in warm.

DIET AND PYORRHEA

A diet that is deficient, or of poor quality, is an important factor leading to pyorrhea, because, when the body vitality is reduced through incorrect diet, bacteria, which are always in the mouth and on the teeth, invade the tissues that support the teeth, and pyorrhea is often the result. Too hearty eating, or an excessive protein diet, associated with faulty elimination (constipation) and intestinal toxemia (poisoning) results in a coating which pours out in the saliva and forms the tartar that is found on the teeth of so many persons. Moderate eating of proper food and extreme mouth cleanliness will avoid this in most cases. This coating is a danger signal and when it is discovered, steps should be taken to correct the diet.

DIET AND DECAY OF THE TEETH (DENTAL CARIES)

Decay of the teeth is now believed to be, in part at least, a result of diet deficiency. The modern American diet of white flour, polished rice, refined sugar, potatoes, peas and beans, muscle meats and margarins is greatly lacking in iron, calcium, phosphorus, essential vitamins and indigestible bulk, and is excessive in fuel producing elements, especially carbohydrates. Such a diet will cause the teeth of dogs, rats and monkeys to decay, and has been proved one of the causes of dental caries (decay) in adults and children.

When one considers that dental decay often is a symptom of a deficiency disease that is occurring in the whole body, one is not surprised that dentists and physicians are turning their attention to dietary reform as a step in the prevention of disease.

HARDNESS OF THE TEETH AND DENTAL CARIES

It has been commonly taught that decay of the teeth occurs because the teeth are soft, and does not occur if their structure is hard. It is now known that the native hardness of the teeth is not an important factor in decay. Teeth vary considerably in their hardness to scratching and permeability to stains and acids. The softest teeth occur in modern people who were poorly nourished as children, while the hardest occur among well-developed savages. The enamel of the temporary teeth is formed before birth, so its formation is affected by faults in the nutrition of the mother during pregnancy. The enamel of the permanent teeth forms from the time of birth to twelve years after birth, and is influenced in its formation by disease or faulty nutrition during this period. But the best formed enamel will succumb to decay if, after the eruption of the teeth, the conditions of diet and hygiene predispose to decay. This is constantly shown in

immigrant children to England and America, who come with beautifully formed teeth from conditions where decay is rare, only to have cavities formed after they arrive and adjust themselves to English and American food and living, as rapidly as in the native children. The structure and formation of the tooth are most important, and so also are the conditions of diet, mastication, nutrition and health after the tooth has erupted.

Another common fallacy is that decay occurs because the mouth is acid. It is seldom indeed that sufficient acid occurs in the mouth to affect the teeth. Acid solution of iron used in medicine will eat into the teeth, and acid eructations from a sour stomach. Other than this, the mouth fluids are practically never appreciably acid. Acid forms and eats into the teeth in spots protected from the mouth fluids. Fruit acids and tasty foods that stimulate a vigorous flow of saliva are beneficial. The saliva is always a protective fluid and never in itself damages the teeth.

DIET AND THE USE OF THE TEETH

It is a well known truth in biology that an organ that is not used tends to disappear. An organ develops by use, and a lack of use prevents proper growth. Modern diet prevents sufficient use of the teeth and exercise of the jaws, and makes them more liable to disease.

Most of the food in the average American diet is so soft that mastication is unnecessary. Children learn to eat with little chewing, and faulty muscle and bone development follows with irregular, crowded teeth, flabby gums and unclean mouth predisposed to disease. In order to grow properly to maturity the jaws require hard work until the time the third molars, sometimes called "wisdom" teeth, have erupted. In other words, during the whole growth period, there is an especial need of vigorous exercise for the masticating machine so that all its parts may develop adequately.

The lack of vigorous use of the teeth is believed to be a main cause in poor development. Growing animals with teeth extracted on one side to prevent use of that side not only have jaws unequally developed on the two sides, but even the bones of the skull are affected, the bones being smaller on the unused side.

Furthermore, it has been shown that thorough mastication and insalivation have a great effect on diet, nutrition and health. Prof. Irving Fisher has shown by experiments on a group of college men that thorough mastication, by its effect on the choice, amount and digestion of the food, markedly increased the health and endurance of these men, thus confirming the ideas that Fletcher advanced many years previously. Plenty of time should be taken for chewing; food should be served that requires chewing, and the habit of thorough mastication should be gained early in infancy. The habit of bolting the food is undoubtedly responsible for much of the constipation and attendant ills, including dental disease.

A good diet should include hard baked rusks, crusts, zwieback, rye krisp and other coarse foods that require chewing. In addition to promoting proper exercise of the teeth and jaws, raw green vegetables, fruits and coarse breads aid

in the cleansing of the teeth and massaging of the gums. However, though correct food and thorough mastication go far toward producing health of the mouth, further artificial cleansing and care are necessary.

Hurry, worry, excessive fatigue, lack of sleep, overeating of concentrated foods (especially meats and sweets), overstimulation of the mind by excitement (movies, jazz, etc.) all tend to create abnormal conditions which are not conducive to the health of the teeth and their supporting structures.

HOME CARE OF THE MOUTH

While it may be possible by the use of correct food, and by efficient mastication, sunshine, fresh air, exercise, recreation, rest and peace of mind to build up and maintain a healthy, clean set of teeth without artificial care, it would be difficult in many cases under our present mode of living, and a dangerous experiment in all. Other parts of the body become diseased when they are uncleansed, so that, for most of us, bathing is essential to health. It certainly is to the health of the teeth and their supporting issues.

THE DENTAL HYGIENIST IN PRIVATE PRACTICE, SCHOOLS AND INSTITUTIONS*

By EDITH HARDY, D.H., Rochester, New York

THE dental hygienist is no longer an experiment but has become an institution. Results have amply proved that the far-seeing vision of those men of the dental profession primarily concerned with the health of the child by the preservation of the teeth in a healthy condition could sooner be realized with the assistance of a trained worker along this particular line.

At the time that the first classes of dental hygienists were formed, it was difficult to decide just what were the essential subjects for study required by such a worker, but, at this time, the curriculums of schools of training for dental hygienists are becoming more nearly uniform, and the preliminary educational requirements are usually based on a four year high school course or its equivalent. At this time, there are eleven schools of training for dental hygienists.

The original field for the dental hygienist was to be that of school oral hygienist, her work to be the teaching of mouth hygiene and the cleaning of the teeth of school children.

It soon became evident that the dentist in private practice, giving much of his time to reparative and restorative dentistry, had little inclination for the work of oral prophylaxis; nor had he the time needed for instruction to adult patients in the care of their mouths or the mouths of their children.

*Read before the Section on Mouth Hygiene, Preventive Dentistry and Public Health at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

The dental hygienist is particularly adapted to this work and is often the means of bringing the children to the dental office at an early age, thus insuring against the loss of deciduous teeth, the result of a lack of knowledge of their importance on the part of the parents.

The child of preschool and kindergarten age is not difficult to manage in the dental office, if properly handled on his first visit. He should be encouraged to ask questions and should be shown the porte polisher and mirror and told something about his teeth. Pictures and a short story relating to a clean mouth will often create an interest, and he will be ready to have his teeth examined and cleaned. He will become ascustomed to the sight of instruments and white coats, accustomed to queer noises and smells, and will more readily allow the doctor to examine his mouth and do any necessary dental operation. Nerve fag (or wiggles) is quite a factor in doing dental work for a child, and he should be dismissed at the first signs of weariness. Small children should have frequent appointments; at least once a month, so that a check on the home care of the mouth can be made. This monthly inspection takes but little time, and cavities are discovered before much damage has been done.

Regular examination and prophylactic treatments are given to adult patients also, the time between visits varying from two to four months, depending on the condition of the mouth. Instruction in brushing the teeth and gum massage is given when indicated, and cavities and any abnormal conditions are noted on a chart. This chart is turned over to the dentist, who makes his own examination and does such work as he considers necessary, checking off cavities that he has filled. The chart is then returned to the dental hygienist for filing.

Appointments for regular prophylactic treatment are made by telephone or through the mail, according to the system worked out by the individual dentist, and are usually taken care of by the dental hygienist. This is the most satisfactory arrangement, as the dental hygienist soon gets to know the most convenient time to give to the patient; but it can be handled by the secretary or office assistant. Each office must adjust itself to the conditions under which it is operated. No rules can be laid down, these depending largely on the size of the staff, the number of patients to be seen each day, etc. Patients soon become accustomed to regular visits, and are only too glad to have the responsibility of making an appointment taken off their shoulders.

In checking up results of regular inspection and prophylaxis, it has been found that, over a period of five or six years, the number of cavities has been lessened, and the general condition of the oral cavity improved, although the actual amount spent for dental service may not have materially changed. This state of affairs is generally quite satisfactory to the patient, as the average man is willing to here invest his money in sound teeth; and if frequent examination and prophylactic treatment will secure this condition, he is willing to pay the price.

Perhaps the greatest field for the dental hygienist lies in the schools. The presence of the dental hygienist in the school room giving lectures on health, showing why poor teeth and diseased conditions of the oral cavity result in poorly nourished bodies, or stressing

the maintenence of healthy bodies and clean mouths, displaying posters showing healthy girls and boys with smiling faces and strong white teeth, will have a psychologic effect on the whole class. Any child who can be taught that it is necessary to take regular baths, brush the hair and wear clean clothing can readily understand the need of cleansing the mouth, and although there may be a high water mark or grubby places behind the ears, not to mention well-scrubbed incisor teeth and much neglected molars, the time will come when a thoroughly cleaned mouth will be as regularly seen as a clean neck and an immaculate collar. The mob spirit still lives among school children, and if the dental hygienist can convince the children that a dirty, unclean mouth is a disgrace to the class and the school, the children will take matters in their own hands and insist that all their classmates live up to the standards that they themselves have set up.

Instruction in schools is given during the regular school hours, a given period being set aside for the dental hygienist for lectures, demonstrations, etc. Sometimes two or three grades are given this instruction at once, this depending on the size of the grade, number of pupils in the school, time allowed and other conditions. Stories are told; plays prepared to be given before the parent-teacher association and posters on suitable subjects made. Competition and rivalry are keen, and a banner or ribbon awarded to the class making the best showing will create an interest among pupils and teachers.

At the first examination, charts are made of each child's mouth, showing the number of times the toothbrush is used each day, date of examination and condition of the mouth, and giving other information. These cards are referred to at each subsequent visit, and a checkup is made. Instruction is given to the children individually where necessary, and if dental work is indicated, a notice is sent home to the parent asking that the child be sent to the family dentist, or if financially unable to have this attended to, he is referred to the school dentist or some institution. Much of the routine work of the school dentist can, in this way, be handled by the hygienist, and therefore more of his time can be given to operative dentistry.

In school, the dental hygienist ranks with the special teachers, and, in large schools, her work is confined to one school. In communities in which the number of pupils is smaller, the hygienist visits several schools, giving lectures and demonstrations before the teachers and pupils. This is followed by prophylactic treatment of the teeth of the children, beginning at the lowest grade. Transportation is provided in these cases by either the board of education, or the board of health, under whose supervision the hygienist is working. In some instances, an automobile is provided, and the hygienist has been known to travel over snow covered highways or miles of dirt roads to reach the outlying schools. Perhaps the most satisfactory results have been obtained in these little red school houses, for the days on which the hygienist is scheduled to be there are looked forward to by the children, and they are sure of an interesting lesson. Today, they may draw milk bottles or green vegetables, or prepare posters for the assembly room. Recently, a progressive school principal conceived the idea of presenting to the girls and boys of the graduating class of a grammar school the ideals

and a brief outline of several businesses and professions, and invited a representative of each of these to give a short talk before the class. The first speaker was the fire chief, and, at the close of his talk, at least 70 per cent of the boys had decided that they would be firemen. The following week a dental hygienist was the speaker. She naturally spoke chiefly to the girls, stressing the idea of service and also giving to the boys some thoughts on the profession of dentistry. This was followed by an appeal to the children to complete their high school education so that, should they decide to enter one of the professions, they would not be handicapped by lack of the preliminary requirements. It was very gratifying to the hygienist to receive a message from the class teacher to the effect that two girls and one boy who had previously signified their intention of going to work in the fall had decided to go to high school.

Little can be accomplished in school work without cooperation, and results depend largely on the attitude of the superintendent of schools, teachers, and the school nurse. If the dental hygienist can impress on these officials the health side of her work, and show, through application, that she is in earnest, gratifying results can be obtained, and the health of the children can be much improved. At the end of a school year, there will be a noticeable reduction in the percentage of failures in class work, and the attendance record will show a pleasing increase.

Perhaps less is known of the work of the dental hygienist in institutions than in any other branch of her profession. It is difficult to obtain statistics, though the number of institutions employing hygienists becomes greater each year.

Many of our orphanages and childrens' homes now have dental hygienists on their staff. The Gould Foundation in New York employs a full-time hygienist, who examines the mouth of all children entering the institution. This is followed by a prophylactic treatment and instruction in the use of the toothbrush and personal care of the mouth. The child is then sent to the staff dentist with the chart showing the findings of the hygienist. This home has a central clearing house where each child is given protective vaccines; tonsils are removed when this is indicated, and the mouth is put into as healthy condition as possible. After the child has been placed in the permanent branch of the home, his teeth are examined and cleaned regularly. Many of the children are in this home for a number of years, and results of this general health program will be watched with interest by the medical and dental professions.

The need of dental service in reform schools and similar institutions is becoming more apparent every year, but, owing to the small salary inducement, few of the younger dentists are able to devote time to this much needed work. A part-time dentist taking care of the emergency cases, and giving regular hours to other cases, could accomplish a great deal more if he had the assistance of a dental hygienist. She could keep the mouth of the children in a clean condition, give instruction in personal care of their mouths, prepare the charts and keep records of work done for each child, thus relieving the dentist of many tedious details.

The dental hygienist has established herself as a necessary part of the hos-

pital staff. It has been found that she can handle successfully the mentally sick patient that needs dental work following prophylactic treatment, when, previously to her employment, the patient refused to let any dentist do this work for them. Several hospitals have asylums employing dental hygienists, the number having more than doubled during the last few years. No positive statement can be made as to the actual number of hygienists in this particular line of work, but as far as is known, no hospital once employing a hygienist has discontinued her employment. Patients who are confined to a hospital for several weeks are often in need of prophylactic treatment, and this can be given to bed as well as ambulant patients. In hospitals having an outpatient dental department, the hygienist gives treatment to many who otherwise would not be able to afford this service. Treatment given to children in the outpatient department is often supplemented by talks to mothers, telling of the necessity of keeping the mouth of the child clean and free from food deposits, and is frequently the means of stimulating interest in the whole community. Both the mother and the child are ready to impart their new knowledge to their neighbors, and, in this way, some children are reached who otherwise would not receive dental treatment.

Such associations as the Philadelphia Child Welfare Organization, the Monroe County (N. Y.) Tuberculosis Association and many others appreciate the work of the dental hygienist, and the day is not far distant when every institution or association interested in the health of the child will have on its staff one or more full-time dental hygienists, working with the staff dentist or the dental society.

Medical and Dental News

Connecticut

Dr. Armstrong Honored: At the annual meeting of the Connecticut State Dental Association, Stanley E. Armstrong, the retiring secretary and treasurer of the organization, was presented with a watch and resolutions as a testimonial of the appreciation of the association for service rendered in the conduct of his office.

Dr. Eberle Honored: Edward Eberle, a practicing dentist of Hartford since 1890 and for eighteen years, until 1921, an active member of the state dental commission, was honored recently at a dinner at the Hartford City Club which was attended by about 100 friends and professional associates. A. W. Crosby, of New Haven, acted as toastmaster. At the close of the evening, Dr. Eberle was presented with a Governor Winthrop secretary, together with an embossed scroll bearing the words "It is our sincere desire that this expression of friendship will be a constant reminder of the high esteem in which we hold you;" and signed by the donors. Dr. Eberle was foremost in the work of ridding the profession in his state of unqualified and incompetent men and in establishing sound dental laws and regulations.

Illinois

Dr. Bebb Leaves Northwestern University: William Bebb, librarian and curator of the museum of Northwestern University Dental School since 1913, severed his connection with the institution, July 1. At the recent commencement celebration, the museum and library were named for Dr. Bebb, whose efforts were responsible for their development.

New York

Dr. Burkhart Oral Hygiene Adviser: Harvey J. Burkhart, director of the Rochester Dental Dispensary, has been appointed consultant in oral hygiene in the state department of health.

Wisconsin

Dr. Banzhaf Honored: Henry L. Banzhaf was honored with a banquet recently by the Wisconsin State Dental Society in recognition of his position as President of the American Dental Association. The president of the state Society, G. A. Stratton, of Oshkosh, presented Dr. Banzhaf with a gavel, mounted in ebony and bearing on one side the seal of the national organization and on the other, the seal of the state society. This was accompanied with a scroll, bearing Dr. Banzhaf's name and the date of presentation. The speakers of the occasion were Willim J. Gies, of New York City, C. N. Johnson, of Chicago, and J. M. Prime, of Lincoln, Nebr. Don M. Gallie, of Chicago, acted as toastmaster. Father Fox, president of Marquette University, of which Dr. Banzhaf is business manager and of whose dental department he is dean, also spoke.

Foreign

First Turkish Women Dentists: Turkey's first women dentists, Gourro and Chandie Hanoums, have just received their diplomas from the Stamboul School of Dentistry. Constantinople, Turkey.—*Indian Dent. Rev.*, June, 1927.

Dental Clinic to Honor Lenin's Memory: The dentists of Russia have just opened a modern dental clinic in Moscow Province, to honor the memory of Lenin. The clinic is located at Gorki, where Lenin died. Treat-

ment at cost or free treatment will be provided there. The clinic is supplementary to the dental laboratories maintained by the state.—*Indian Dent. Rev.*, June, 1927.

Degrees for Prominent Dentists: The University of Pennsylvania conferred the honorary degree of doctor of laws on the following delegates to the Seventh International Dental Congress: Floristan Aguilar of Madrid, Ernst Jessen, of Basel, Switzerland, W. H. Gilmour, Liverpool, England, and William Guy of Edinburgh, Scotland.—*Indian Dent. Rev.*, June, 1927.

Dental Service in Rotterdam Schools: Following the example of other cities, Rotterdam is planning to organize a dental service in the schools, which will not only comprise an inspection service but also provide a gratuitious treatment for children who obtain the consent of their parents. It is estimated that the annual expense involved will amount to about thirty cents per pupil.—Netherlands letter, *J.A.M.A.*, July 16, 1927.

Eastman Dispensary: Plans are going forward for the $1,500,000 dental dispensary made possible through the gift of Mr. George Eastman. The dispensary will be connected with the Royal Free Hospital, which is in a district made up of people of the lower and middle classes. The directors of the hospital have guaranteed to raise the necessary funds to provide for the running expenses of the dispensary. It is hoped to have a fifty-chair infirmary and an orthodontic department of seven chairs. Twenty-five beds will be provided for tonsil, adenoid and cleft palate cases. It is expected that the plans for building and operating the dispensary were to follow closely those of the Rochester Dental Dispensary, the gift of Mr. Eastman to Rochester, N. Y.

Dr. Jackson Presents Course on Broncho-Esophagoscopy in Paris: During the month of July, Chevalier Jackson of the Jefferson and University Bronchoscopic clinics of Philadelphia, presented a course of five lectures and clinics before the Faculty of Medicine of the University of Paris, on the various phases of broncho-esophagoscopy.

General

Laboratory Worker to Be Appointed: Arrangements have been made for the selection of a research worker in the laboratory of the American Medical Association, to consider problems of mutual interest to the dental and medical professions, for the benefit of the American Dental Association.

Women Denists: Women have shown an increasing tendency to engage in dental practice. The growth in their number in the United States is indicated by these census figures: 1870—24; 1880—61; 1890—337; 1900—807; 1910—1254; 1920—1829; 1926—2100 (estimated). Nearly all of the dental schools in North America are open to them. The present attendance is approximately 200.—*Carnegie Foundation for Advancement of Teaching, Bull. 19.*

Dental Trade Association Meets: The forty-sixth annual meeting of the American Dental Trade Association was held in Asheville, N. C., June 13-17. Dr. Otto U. King, General Secretary of the American Dental Association, addressed the general session, Friday evening, June 17, on the subject "Organization Will Widen the Vision."

New Dental Society Organized: A new component society, to be known as the Potomac Valley Dental Society, has been organized to cover the territory originally served by the Potomac Dental Society, which will now be known as the Tuscarora Dental Society, with G. B. Geyer, Martinsburg, W. Va., as secretary.

Deaths

Baldridge, B. A., Cherry Forks, Ohio; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1917; died, June 2; aged 32.

Barber, C. W., Wyoming, Ill.; Pennsylvania College of Dental Surgery; 1882; died, May 18.

Benkart, John F., Pittsburgh, Pa.; died, May 28; aged 84. Dr. Benkart was born in Prussia. He had practiced in Pittsburgh for more than fifty years.

Caughron, John R., Oklahoma City, Okla.; University of Tennessee, College of Dentistry, 1904; died, August 3, of apoplexy.

Collier, Henry Philip, Stephens, Ark; St. Louis University, School of Dentistry, 1916; died, May 20; aged 38.

Faulk, Joseph Edward, Brooklyn, N. Y., Thomas W. Evans Museum and Dental Institute, School of Dentistry, Univerity of Pennsylvania, 1895; died, June 15; aged 51.

AMERICAN DENTAL ASSOCIATION SIXTY-NINTH ANNUAL SESSION

DETROIT, MICHIGAN, OCTOBER 24, 25, 26, 27, 28, 1927

OFFICIAL CALL

To the Officers, Members and Constituent Societies of the American Dental Association:

You are hereby notified that the Sixty-Ninth Annual Session of the American Dental Association will be held at Detroit, Mich., Oct. 24-28, 1927.

The House of Delegates will convene at 10:00 o'clock in the forenoon and 2:30 o'clock in the afternoon, Monday, October 24, in the Book-Cadillac Hotel. The third and fourth meetings of the House of Delegates will be held Wednesday and Thursday, October 26 and 27, at 2:30 o'clock in the same hotel. The Credentials Committee will register all delegates and alternates, beginning 9 a. m., Monday, at the Book-Cadillac Hotel. All other members must register at the Registration Office in the General Motors Building.

The general meeting, which constitutes the opening exercises of the Session, will be held Tuesday, October 25, at 9:40 a. m., in the Auditorium of the General Motors Building, and general meetings will be held at 8:00 p. m. on that and subsequent days of the Session in the Ballroom of the Book-Cadilllac Hotel.

The various sections, general clinics, section clinics, Dental Health exhibit, scientific exhibit, motion picture program and technical exhibits will be held in the General Motors Building, according to their respective programs.

The Registration Department will be open from 8:30 a. m. until 5:00 p. m., Monday, Tuesday, Wednesday, Thursday and Friday, October 24, 25, 26, 27 and 28, in the General Motors Building.

The constituent societies are hereby notified to file with the General Secretary of this Association, at least thirty (30) days prior to the first day of said Annual Session, a list of the names and addresses of their delegates and alternates.

HENRY L. BANZHAF, *President.*
OTTO U. KING, *General Secretary.*

MEMBERS OF THE HOUSE OF DELEGATES 1927*

DELEGATES AND ALTERNATES

ALABAMA

Delegates

Olin Kirkland, Shepherd Bldg., Montgomery
J. A. Blue, Empire Bldg., Birmingham
F. F. Perry, Shepherd Bldg., Montgomery

Alternates

H. Clay Hassell, Tuscaloosa
C. W. Lokey, Empire Bldg., Birmingham
H. T. McKinnon, Troy

ARKANSAS

Delegates

J. D. Jordan, Boyle Bldg., Little Rock
James T. Peay, Bankers Trust Bldg., Little Rock

Alternates

F. G. White, 1st Nat'l Bk. Bldg., Fort Smith
J. S. Rushing, 212 Armstrong Bldg., El Dorado

ARMY DENTAL CORPS

Delegate

Col. Robert T. Oliver, D.C., School of Dentistry, Univ. of Pennsylvania, Philadelphia, Pa.

*This list will be revised, September 24, 1927, in accordance with the ruling as presented in the Constitutional By-Laws, under Chapter IV: Sec. 3—The number of delegates to which each constituent society may be entitled shall be based on the number of members from whom dues for the current year shall have been received by the general secretary of this Association at least thirty days prior to the first day of the annual Session of this Association. . . . Sec. 6—Previous to the annual Session the general secretary of this Association shall prepare and have printed a list of the delegates and alternates, elected by the various constituent societies; also the number of paid members of each.

Alternate

Major Neal A. Harper, D.C., College of Dentistry, Ohio State University, Columbus, Ohio

CALIFORNIA STATE

Delegates

R. H. Blanquie, 870 Market St., San Francisco
James Allen Graham, 209 Post St., San Francisco
Arthur R. McDowell, 344 Fourteenth St., San Francisco
Guy S. Millberry, 1st and Parnassus Aves., San Francisco
Sanford M. Moose, Flood Bldg., San Francisco
George Selleck, 605 Physicians Bldg., San Francisco

Alternates

Max Wassman, Jr., 323 Geary St., San Francisco
Frederick T. West, 2509 Mission St., San Francisco

COLORADO

Delegates

W. T. Chambers, 719 Metropolitan Bldg., Denver
E. R. Warner, 412 Metropolitan Bldg., Denver
M. R. Howard, Metropolitan Bldg., Denver

Alternates

V. Clyde Smedley, 1206 Republic Bldg., Denver
E. E. Bailey, 1124 Republic Bldg., Denver

CONNECTICUT

Delegates

E. Frank Cory, 62 Trumbull St., New Haven
J. A. Bray, 57 Pratt St., Hartford
Clarence G. Brooks, 302 State St., New London
Morton J. Loeb, 66 Trumbull St., New Haven

Alternates

S. E. Armstrong, 129 Whitney Ave., New Haven
J. W. Borchardt, 108 Bank St., Waterbury
A. C. Fones, 10 Washington Ave., Bridgeport
W. L. Weed, 54 S. Main St., South Norwalk

DELAWARE

Delegate

W. S. P. Combs, Middletown

Alternate

Robert E. Price, Marlboro Apts., Wilmington

DISTRICT OF COLUMBIA

Delegates

Mark F. Finley, 1928 I St., N. W., Washington
C. W. Camalier, 1029 Vermont Ave., Washington

Alternates

E. S. Smith, 1101 17th St., N. W., Washington
Charles D. Cole, The Farragut, Washington

FLORIDA

Delegates

C. J. Caraballo, 713 Stovall Bldg., Tampa
H. B. Pattishall, 312 Peninsular Bldg., Jacksonville

Alternates

A. W. Sears, 616 Professional Bldg., Jacksonville
F. C. Boardman, 102 South Orange St., Orlando

GEORGIA

Delegates

DeLos L. Hill, 562 Peachtree St., Atlanta
J. Russell Mitchell, Candler Bldg., Atlanta
M. D. Huff, 1204 Medical Arts Bldg., Atlanta

Alternates

A. A. Lawry, Valdosta
F. C. Wilson, 12 Jones St., E., Savannah
R. R. Byrnes, 160 Forrest Ave., N.E., Atlanta

IDAHO

Delegate

R. J. Cruse, Pocatello

Alternate

A. G. Miller, St. Anthony

ILLINOIS

Delegates

T. L. Grisamore, 29 E. Madison St., Chicago
A. E. Converse, Leland Office Bldg., Springfield
A. B. Patterson, 406 Heggie Bldg., Joliet
G. Walter Dittmar, 59 E. Madison St., Chicago
Arthur D. Black, 122 S. Michigan Ave., Chicago
C. N. Johnson, 58 E. Washington St., Chicago
E. F. Hazell, 608 E. Capitol Ave., Springfield
J. P. Luthringer, 608 Jefferson Bldg., Peoria
D. M. Gallie, Jr., 25 E. Washington St., Chicago
F. B. Noyes, 30 N. Michigan Ave., Chicago
William H. G. Logan, 29 E. Madison St., Chicago
P. G. Puterbaugh, 29 E. Madison St., Chicago
W. A. McKee, Benton
T. A. Broadbent, 25 E. Washington St., Chicago
E. L. Burroughs, Edwardsville
F. C. Hopkins, 401 Commercial Bldg., Alton
H. J. Goslee, 108 N. State St., Chicago

Alternates

Howard S. Layman, Leland Office Bldg., Springfield
P. A. Pyper, 209 Sterry Block, Pontiac
J. H. Prothero, 25 E. Washington St., Chicago
E. W. Elliott, 39 S. State St., Chicago
G. G. Knapp, 1203 W. Garfield Blvd., Chicago
O. H. Seifert, 603 Myers Bldg., Springfield
Harold S. Smith, 180 N. Michigan Ave., Chicago
C. B. Brownell, 523 Jefferson Bldg., Peoria
B. S. Partridge, 1305 E. 63rd St., Chicago
M. M. Printz, 185 N. Wabash Ave., Chicago
G. N. West, 30 N. Michigan Ave., Chicago
J. H. Cadmus, 185 N. Wabash Ave., Chicago
F. F. Molt, 25 E. Washington St., Chicago
H. E. Phillips, 5457 S. Ashland Ave., Chicago
C. Carroll Smith, 307 S. Bourland St., Peoria
F. G. Conklin, 523 S. Crawford Ave., Chicago
F. E. Gillespie, Oak Park Trust Bldg., Oak Park

INDIANA

Delegates

W. A. Hall, 107½ East Tenth St., Michigan City
F. R. Henshaw, 904 Medical Arts Bldg., Indianapolis
W. E. Neuenschwander, 401 Medical Arts Bldg., Ft. Wayne

A. R. Ross, Murdock Bldg., Lafayette
C. R. Jackson, 904 Hume Mansur Bldg., Indianapolis
C. E. Redmon, 13½ West Third St., Peru
P. H. Chadwick, 130 East Second St., Rushville

Alternates

R. N. Douglas, 506 South 2nd St., Elkhart
R. R. Gillis, 56 Rimbach Ave., Hammond
Charles A. Priest, 509 Marion Nat. Bk. Bldg., Marion
W. O. Vallette, 113 South Fifth St., Goshen
L. E. Van Osdol, 5½ E. Third St., Peru
W. R. Meeker, Wallace Theater Bldg., Peru
Victor H. Knapp, 510 Citizens Bk. Bldg., Evansville

IOWA

Delegates

John Scholten, 306 American Trust Bldg., Cedar Rapids
H. E. Latchem, 805 Frances Bldg., Sioux City
F. N. Ralston, 603 Iowa Nat. Bk. Bldg., Des Moines
F. H. Waters, Ames
H. D. Coy, Hamburg
H. F. Pool, Mason City

Alternates

Earle S. Smith, 613 E. Court St., Iowa City
H. J. Altfillisch, 501 Bank & Insurance Bldg., Dubuque
W. R. Garretson, Knoxville
C. E. Westwood, 605 Frances Bldg., Sioux City
R. W. Noland, 1113 Equitable Bldg., Des Moines
W. U. Hammer, Atlantic

KANSAS

Delegates

G. A. Crise, Manhattan
F. O. Hetrick, Ottawa
George E. Burket, Kingman
E. C. Glass, Independence

Alternates

A. J. Buff, Mills Bldg., Topeka
W. T. Triplett, Salina
H. B. Robison, Great Bend
C. E. Tuttle, 706 Orpheum, Wichita

KENTUCKY

Delegates

E. C. Hume, 814 Francis Bldg., Louisville
W. M. Randall, 1035 S. Second St., Louisville
R. P. Thomas, 3324 W. Broadway, Louisville
G. H. Means, 1380 Bardstown Rd., Louisville

Alternates

C. S. Pearcy, Starks Bldg., Louisville
J. H. Fullenwider, Francis Bldg., Louisville
R. H. Benson, Madisonville
J. H. Feamster, Frankfort

LOUISIANA

Delegates

S. S. Grosjean, 816 Howard Ave., New Orleans
C. P. Kelleher, 611 Macheca Bldg., New Orleans
Walter Leabo, 503 Ricon-Brewster Bldg., Shreveport

Alternates

Leo J. Schoeny, Donaldsonville
H. J. Feitus, Baton Rouge
Fred Ratzberg, 722 Slattery Bldg., Shreveport

MAINE

Delegates

Carl W. Maxfield, Bangor
Fred S. Woods, Portland

Alternates

Gerald P. Clifford, Portland
Donald M. Small, Kennebunk

MARYLAND

Delegates

Horace M. Davis, Professional Bldg., Baltimore
A. H. Paterson, Howard & Madison Sts., Baltimore
J. Ben Robinson, 219 W. Monument St., Baltimore

Alternates

George M. Anderson, 806 Cathedral St., Baltimore
J. C. Fowler, 3939 Greenmount Ave., Baltimore
Harry E. Kelsey, 833 Park Ave., Baltimore

MASSACHUSETTS

Delegates

Norman B. Nesbett, 125 Marlboro St., Boston
Amos I. Hadley, 125 Marlboro St., Boston
William Rice, 416 Huntington Ave., Boston
Leroy M. S. Miner, 363 Marlboro St., Boston
Harold W. Alden, 160 Main St., Northampton
W. Henry Grant, 107 Massachusetts Ave., Boston
William H. Gilpatric, 358 Commonwealth Ave., Boston
Frank T. Taylor, 419 Boylston St., Boston
Frank A. Delabarre, 520 Beacon St., Boston

Alternates

Frank H. Cushman, 475 Commonwealth Ave., Boston
Philip E. Adams, 236 Newbury St., Boston
Fred G. Rollins, 358 Commonwealth Ave., Boston
James W. Rice, 358 Commonwealth Ave., Boston
Varaztad H. Kazanjian, 475 Commonwealth Ave., Boston
Walter C. Bridge, 416 Huntington Ave., Boston
Frederick S. Fogg, 551 Boylston St., Boston
Leon A. Storz, Tucherman St., Worcester
Frank P. Simpson, 18 Bank Row, Pittsfield

MICHIGAN

Delegates

Chalmers J. Lyons, 1004 Oakland Ave., Ann Arbor
Edwin J. Chamberlain, 519 Ashton Bldg., Grand Rapids

William E. Brown, Fidelity Bldg., Benton Harbor
Marcus L. Ward, 1308 Cambridge Rd., Ann Arbor
James D. Locke, 216 Metz Bldg., Grand Rapids
Patrick J. O'Reilly, 4622 Grand River Ave., Detroit
H. F. Parks, 40 Sun Bldg., Jackson

Alternates

P. C. Lowery, 8455 Gratiot Ave., Detroit
E. A. Honey, Sr., 903 Hanselman Bldg., Kalamazoo
Ward Moore, 1426 Grand Rapids Nat. Bk. Bldg., Grand Rapids
George C. Bowles, Sr., 2970 W. Grand Blvd., Detroit
R. E. Patterson, 901 Stroh Bldg., Detroit
F. Harold Essig, 405 Green St., Dowagiac

MINNESOTA

Delegates

C. H. Turnquist, 505 Donaldson Bldg., Minneapolis
Harry W. Nelson, 801 Physicians & Surgeons Bldg., Minneapolis
Max E. Ernst, 1150 Lowry Bldg., St. Paul
C. O. Flagstad, 401 Yeates Bldg., Minneapolis
T. B. Hartzell, 710 Physicians & Surgeons Bldg., Minneapolis
O. DeForest Davis, 703 Yeates Bldg., Minneapolis
C. E. Rudolph, 905 Metropolitan Bk. Bldg., Minneapolis

Alternates

J. A. Heidbrink, 616 Donaldson Bldg., Minneapolis
W. D. Vehe, 823 Nicollet Ave., Minneapolis
H. B. Washburn, 462 Lowry Bldg., St. Paul
Walter H. Smith, 2337 Central Ave., Minneapolis
Boyd S. Gardner, Rochester
A. S. Wells, 700 Physicians & Surgeons Bldg., Minneapolis
Benjamin Sandy, 901 Yeates Bldg., Minneapolis

MISSISSIPPI

Delegates

W. R. Wright, Jackson
J. F. Brunson, Meridian

Alternates

R. S. Neyland, Jackson
B. B. Kennedy, Jackson

MISSOURI

Delegates

W. M. Bartlett, Wall Bldg., St. Louis
J. P. Harper, St. Louis University, School of Dentistry, St. Louis
Hugh G. Tanzey, Mill Creek Blvd., at 47th St., Kansas City
George E. Haigh, Jefferson City
Jesse Miller, Maryville
Charles W. Digges, Columbia
J. W. Hull, 609 Commerce Bldg., Kansas City

Alternates

O. W. Brandhorst, Lister Bldg., St. Louis
G. B. Scott, Missouri Bldg., St. Louis
J. Emmett Northcutt, 602 Argyle Bldg., Kansas City
V. R. McCue, Physicians & Surgeons Bldg., St. Joseph
C. H. Weaver, Franklin Short Bldg., Sedalia
M. M. House, 105 Hunter Ave., Kansas City
J. B. McBride, Landers Bldg., Springfield

MONTANA

Delegates

C. M. Orser, Kalispell
A. P. Whittemore, Great Falls

Alternates

A. A. Baker, Glendive
F. J. Bell, Billings

NATIONAL CAPITAL

Delegate

M. M. Dolmage, 1029 Vermont Ave., Washington, D. C.

Alternate

Manley Michaels, 1029 Vermont Ave., Washington, D. C.

NAVY DENTAL CORPS

Delegate

Commander Lucian C. Williams, Dental Division, Bureau of Medicine and Surgery, Navy Dept., Washington, D. C.

Alternate

Lieutenant Commander William L. Darnall, Dental Dept., Naval Medical School, Washington, D. C.

NEBRASKA

Delegates

E. H. Bruening, 620 City Nat. Bk. Bldg., Omaha
H. E. King, 546 Peters Trust Bldg., Omaha
G. A. Grubb, 143 North 13th St., Lincoln
P. T. Barber, 804 City Nat. Bk. Bldg., Omaha

Alternates

O. H. Cressler, North Platte
F. F. Whitcomb, 532 Paxton Blk., Omaha
C. E. Brown, 806 Security Mutual Bldg., Lincoln
R. W. Ludwick, 402 Barkley Blk., Lincoln

NEVADA

Delegate

C. E. Rhodes, F. & M. Bldg., Reno

Alternate

Bruce Saulter, Medico-Dental Bldg., Reno

NEW JERSEY

Delegates

John S. Owens, 109 North 5th St., Camden
Matthew C. Pearce, 308 Main St., Orange
Richard S. Hopkins, 913 Broad St., Newark
William H. Gelston, 40 North 30th St., Camden
F. H. Lum, Jr., Main St., Chatham
William E. Truex, 16 West Main St., Freehold

Alternates

A. T. Vickers, 509 Cooper St., Camden
W. W. Hodges, Raritan Bldg., Perth Amboy
Sandal Hirsch, 253½ Clinton Ave., Newark
F. C. McLane, Central Bldg., Paterson
A. E. Boice, Broad St. Bk. Bldg., Trenton
E. C. Stillwell, 71 Winsor Pl., Glen Ridge

NEW MEXICO

Delegate

E. G. Brentari, Belen

Alternate

C. A. Eller, First Nat. Bk. Bldg., Albuquerque

NEW YORK

Delegates

Martin Dewey, 17 Park Ave., New York City
F. A. Gough, 184 Joralemon St., Brooklyn
George VanDerPool, 90 State St., Albany
Harold R. Mead, 6 Eagle St., Schenectady
M. J. Terry, Dept. of Education, Albany
H. D. Whitmarsh, Sr., 122 Oak St., Binghamton
E. G. Link, 226 Cutler Bldg., Rochester
Louis Meisburger,* c/o L. Halliday, 468 Delaware Ave., Buffalo.
William C. Fisher, Bronxville
John T. Hanks, 17 Park Ave., New York City
H. J. Burkhart, Box 35, East Avenue P. O., Rochester
R. Ottolengui, 80 W. 40th St., New York City
William A. Squires, 115 Broadway, New York City
G. G. Pritchard, 468 Delaware Ave., Buffalo
P. R. Ashplant, 170 Grand St., Newburgh
Theodor Blum, 140 W. 57th St., New York City
A. S. Hitzelberger, Utica
C. F. Baylis, Main St., Oneonta

Alternates

Arthur S. Litten, 140 W. 69th St., New York City
Thaddeus P. Hyatt, 1169 83rd St., New York City
P. S. Oakley, 1647 Fifth Ave., Troy
S. A. Demarest, Insurance Bldg., Glens Falls
E. R. Webb, 415 University Bldg., Syracuse
Fred B. Howe, 411 Savings Bk. Bldg., Ithaca
Gerald G. Burns, 605 Professional Bldg., Rochester
W. Ray Montgomery, The Westbrook Apts., Buffalo
C. T. Vail, 260 Valentine Lane, Yonkers
John L. Peters, 133 West 72nd St., New York City
B. W. Palmer, 89 East Ave., Rochester
Joseph A. Burgun, 184 Joralemon St., New York City
C. A. Vetter, 40 E. 41st St., New York City
Robert J. Murray, 1829 Anthony Ave., New York City
T. C. Swift, 1 Park Ave., Mt. Vernon
Russel W. Tench, 116 Central Park, S., New York City
E. I. Harrington, Watertown
Harvey S. DeWitt, Middletown

*Deceased

NORTH CAROLINA

Delegates

B. F. Hall, Asheville
J. C. Watkins, Winston-Salem
H. O. Lineberger, Raleigh

Alternates

Dennis F. Keel, Greensboro
R. A. Little, Asheville
E. B. Howle, Raleigh

NORTH DAKOTA

Delegates

Albert Hallenberg, Fargo
C. A. Putney, Fargo

Alternates

R. W. Pote, Fargo
W. E. Hocking, Devils Lake

OHIO

Delegates

J. V. Gentilly, 764 Rose Bldg., Cleveland
T. I. Way, Doctors Bldg., Cincinnati
C. W. Mills, Chillicothe
Harry Cope, 327 E. State St., Columbus
W. A. Price, 8926 Euclid Ave., Cleveland
G. C. Nixon, Mahoning Nat. Bk. Bldg., Youngstown
F. M. Casto, 1334 Keith Bldg., Cleveland
E. C. Mills, 255 E. Broad St., Columbus
J. W. Hartshorn, 608 Nicholas Bldg., Toledo

Alternates

C. W. Strosnider, 683 E. Broad St., Columbus
W. H. Hayden, 228 Lincoln Ave., Youngstown
J. K. Douglas, Sandusky
J. J. Welker, 1143 Ohio Bldg., Toledo
E. S. Braithwaite, Griffin-Meier Bldg., Willard
P. J. Aufderheide, 668 Rose Bldg., Cleveland
A. O. Ross,* 807 North High St., Columbus
C. S. Smith, 511 Neave Bldg., Cincinnati
G. H. Williamson, Portsmouth

OKLAHOMA

Delegates

A. E. Bonnell, 402 Surety Bldg., Muskogee
C. R. Lawrence, Enid
W. T. Jacobs, 205½ Barnes Bldg., Muskogee

Alternates

C. L. White, Medical Arts Bldg., Oklahoma City
S. A. Long, McAlester
Fred D. Sparks, Ponca City

OREGON

Delegates

H. C. Fixott, Morgan Bldg., Portland
H. C. Miller, N. P. College, Portland
Treve Jones, Medical Arts Bldg., Portland
A. J. Brock, Selling Bldg., Portland

Alternates

Clyde Mount, Oregon City
George S. McCord, Baker
H. C. Walrath, N. P. College, Portland
Charles L. Stolte, Oregonian Bldg., Portland

PENNSYLVANIA

Delegates

P. V. McParland, 706 Highland Bldg., Pittsburgh
J. C. Nugent, Central Trust Bldg., Altoona
H. E. Friesell, Schenley Apts., Oakland Sta., Pittsburgh
R. E. Black, Huntington
C. R. Turner, Evans Institute, Philadelphia
Z. T. Jackaway, 1506 E. Susquehanna Ave., Philadelphia
W. H. Fordham, Connell Bldg., Scranton
O. J. Specker, 51 N. 4th St., Reading
L. P. Anthony, 211 S. 12th St., Philadelphia
W. E. Lotz, Tyrone
A. P. Lee, 235 S. 15th St., Philadelphia
E. R. Sausser, 235 S. 15th St., Philadelphia
George Coleman, 15th & Locust Sts., Philadelphia
R. H. D. Swing, 226 S. 15th St., Philadelphia

Alternates

F. D. Miller, Altoona
C. W. Hagan, 1011 Macon Ave., Swissvale
A. C. Barclay, 914 Highland Bldg., Pittsburgh
Bruce P. Rial, 4506 Fifth Ave., Pittsburgh
W. L. Fickes, East End Trust Bldg., Pittsburgh
D. B. Williams, West Northampton St., Wilkes-Barre
A. C. Young, 121 University Place, Pittsburgh
A. I. Wise, Schmidt Bldg., Pittsburgh
S. B. Luckie, Chester
T. A. Hogan, Jenkins Arcade Bldg., Pittsburgh
W. E. Mendel, 405 E. Ohio St., Pittsburgh
W. A. McCready, Highland Bldg., Pittsburgh
A. H. Reynolds, 4630 Chester Ave., Philadelphia
R. E. Denney, 609 Flanders Bldg., Philadelphia

PUBLIC HEALTH SERVICE

Delegate

C. T. Messner, Office of Surgeon General, U. S. Public Health Service, Washington, D. C.

Alternate

F. C. Cady, U. S. Coast Guard Academy, New London, Conn.

RHODE ISLAND

Delegates

Ambrose H. Lynch, 511 Westminster St., Providence
B. Cecil Burgess, 56 Snow St., Providence

Alternates

Frank P. Duffy, 982 Main St., West Warwick
William J. McGovern, 830 Park Ave., Auburn

SOUTH CAROLINA

Delegates

George W. Dick, Sumter
M. L. Brockington, Florence

Alternates

G. A. Milner, Aiken
E. A. Early, Darlington

SOUTH DAKOTA

Delegates

G. G. Kimball, Mitchell
J. W. Smoots, Spearfish

Alternates

Ernest W. Elmen, Sioux Falls
J. L. Martin, Vermillion

SOUTHERN CALIFORNIA

Delegates

C. O. McBean, Hollingsworth Bldg., Los Angeles
Bert Boyd, 1010 Story Bldg., Los Angeles
J. P. Buckley, 1550 Hayworth Ave., Hollywood
L. E. Ford, 16th & Los Angeles Sts., Los Angeles
J. Franklyn Cook, 511 S. Bonnie Brae Ave., Los Angeles.
W. H. Spinks, 912 Roosevelt Bldg., Hollywood

Alternates

J. L. Howard, 612 Security Bk. Bldg., Hollywood
J. W. Neblett, Hayt Blk., Hollywood
C. C. Noble, 1741 Crenshaw Blvd., Los Angeles
Frederick A. Bricker, 6381 Hollywood Blvd., Hollywood
C. B. Parkinson, 218 American Nat. Bk. Bldg., Monrovia
T. W. Snipes, 65 No. Madison St., Pasadena

TENNESSEE

Delegates

F. W. Meacham, Hamilton Nat. Bk. Bldg., Chattanooga
C. E. Hines, Central Bank Bldg., Memphis
G. L. Powers, Bank of Commerce Bldg., Memphis

Alternates

D. P. Houston, Hamilton Nat. Bk. Bldg., Chattanooga
R. Boyd Bogle, Medical Arts Bldg., Nashville
J. W. Winn, Lambuth Bldg., Nashville

TEXAS

Delegates

H. W. Hoffer, Kaufman
H. M. Davison, Hubbard
W. R. Weber, Littlefield Bldg., Austin
W. O. Talbot, Medical Arts Bldg., Fort Worth
A. L. Frew, 4105 Live Oak St., Dallas
R. E. Lee, Edna

Alternates

A. Frank Walters, Medical Arts Bldg., Dallas
W. B. McCall, Scott & White Hospital, Temple
S. B. Riggs, 801 Medical Arts Bldg., San Antonio
Edward L. Williams, Medical Arts Bldg., Houston
Walter T. Newton, Scanlan Bldg., Houston
F. F. Brown, Wichita Falls

VERMONT

Delegate

Earl E. Johnson, Rutland

VIRGINIA

Delegates

H. Wood Campbell, Suffolk
M. B. Rudd, 502 Methodist Pub. Co. Bldg., Richmond
Guy R. Harrison, Professional Bldg., Richmond

Alternates

Harry Bear, 410 Professional Bldg., Richmond
J. E. John, Roanoke
W. G. Delp, Rural Retreat

WASHINGTON

Delegates

A. L. Martin, Medical & Dental Bldg., Seattle
F. W. Hergert, Medical & Dental Bldg., Seattle
James E. Chilson, Medical & Dental Bldg., Seattle
C. J. Stansbery, Medical & Dental Bldg., Seattle
J. W. Finley, Exchange Bldg., Bellingham
F. G. Burrell, Cobb Bldg., Seattle
A. H. Woolson, Paulsen Bldg., Spokane

WEST VIRGINIA

Delegates

H. L. Satterfield, Fairmount
Fred E. Hess, Fairmount
W. E. Minghini, Martinsburg

Alternates

F. W. Black, Bluefield
G. B. Geyer, Martinsburg
H. J. Scott, Clarksburg

WISCONSIN

Delegates

M. H. Mortonson, 414 1st Nat. Bk. Bldg., Milwaukee
T. A. Hardgrove, Fond du Lac
R. W. Huegel, 104 King St., Madison
J. J. Wright, 1218 Wells Bldg., Milwaukee
J. F. Mortell, Oshkosh
J. C. Mortonson, 425 E. Water St., Milwaukee
G. A. Stratton, Oshkosh

Alternates

E. C. Wetzel, Majestic Bldg., Milwaukee
J. W. Crawford, 1st Wisconsin Nat. Bk. Bldg., Milwaukee
D. P. Wheeler, Madison
B. D. Ising, Oshkosh
G. E. Cleophas, Beloit
T. M. Welsh, Waupun
M. L. Christensen, Oshkosh

WYOMING

Delegate

Peter Appel, Jr., Hynds Bldg., Cheyenne

Alternate

William Focher, Casper

TRUSTEES

Frederick H. Lum, Jr., 151 Main St., Chatham, New Jersey
Sheppard W. Foster, 711 Peachtree St., Atlanta, Georgia
Harold S. Smith, 180 N. Michigan Ave., Chicago, Illinois
John F. Stephan, 1034 Keith Bldg., Cleveland, Ohio
William F. Walz, 159 E. Main St., Lexington, Kentucky
Frank T. Taylor, 419 Boylston St., Boston, Massachusetts
C. C. Allen, 10th and Troost Sts., Kansas City, Missouri
Charles M. Benbrook, 707 Auditorium Ag., Los Angeles, California
R. H. Volland, Iowa City, Iowa

PAST PRESIDENTS

E. T. Darby, Philadelphia, Pa., 1883-1884
J. D. Patterson, Kansas City, Mo., 1892-1893
Harvey J. Burkhart, Rochester, N. Y., 1898-1899
M. F. Finley, Washington, D. C., 1905-1906
A. H. Peck, Chicago, Ill., 1906-1907
A. R. Melendy, Knoxville, Tenn., 1911-1912
F. O. Hetrick, Ottawa, Kan., 1912-1913
Homer C. Brown, Columbus, Ohio, 1913-1914
Donald McKay Gallie, Sr., Chicago, Ill., 1914-1915
Thomas P. Hinman, Atlanta, Ga., 1915-1916
Lafayette L. Barber, Toledo, Ohio, 1916-1917
William H. G. Logan, Chicago, Ill., 1917-1918
C. Victor Vignes, New Orleans, La., 1918-1919
John V. Conzett, Dubuque, Iowa, 1919-1920
H. E. Friesell, Pittsburgh, Pa., 1920-1921
Thomas B. Hartzell, Minneapolis, Minn., 1921-1922
J. P. Buckley, Hollywood, Calif., 1922-1923
William A. Giffen, Detroit, Mich., 1923-1924
C. N. Johnson, Chicago, Ill., 1924-1925
Sheppard W. Foster, Atlanta, Ga., 1925-1926

MOTION PICTURE PROGRAM*

AMERICAN DENTAL ASSOCIATION MEETING, DETROIT, MICHIGAN

(Motion Picture Hall, Auditorium J)

OFFICERS

Otto U. King, General Chairman ..... Chicago, Ill.
Evelyn C. Schmidt, Acting Chairman ..... Chicago, Ill.
(Director, Department of Dental Health Education, American Dental Association)
George W. Christiansen, Local Chairman ..... Detroit, Mich.

Monday, October 24

A. M.

10:00-10:30 "Health Twins at Work"
American Social Hygiene Association, New York City.

10:30-11:00 "Working for Dear Life"
Metropolitan Life Insurance Company, New York City.

11:00-11:15 "Your Mouth"
Edwin N. Kent, Boston, Mass.

11:15-11:30 "The Dental Hygienist"
Alfred C. Fones, Bridgeport, Conn.

11:30-11:45 "Through Life's Windows"

11:45-12:00 "Tommy's Tooth Troubles"
New York Tuberculosis and Health Association, New York City.

P. M.

2:00- 2:15 "Tommy Tucker's Tooth"
Thomas B. McCrum, Kansas City, Mo.

2:15- 2:30 "The Epithelial Inlay"
U. S. Army Medical Museum, Washington, D. C.

2:30- 2:45 "He Who Laughs Last"
New York Tuberculosis and Health Association, New York City.

2:45- 3:00 "Clara Cleans Her Teeth"
Thomas B. McCrum, Kansas City, Mo.

3:00- 3:45 "Pasteur," I, II, III. This film, a history of the life and work of Louis Pasteur, is a gift to the U. S. Department of Agriculture from the French Government. U. S. Department of Agriculture, Washington, D. C.

3:45- 4:15 Demonstrations by Hygienists of the Rochester Dental Dispensary.
Harvey J. Burkhart, Rochester, N. Y.

4:15- 5:00 "The Science of Life" I, II, III, IV.
U. S. Public Health Service, Washington, D. C.

*This program is run strictly on schedule. The program is subject to change; changes will be announced on the bulletin board at the Motion Picture Hall.

Tuesday, October 25

A. M.

9:00- 9:45 "Pasteur," IV, V, VI. This film, a history of the life and work of Louis Pasteur, is a gift to the U. S. Department of Agriculture from the French Government. U. S. Department of Agriculture, Washington, D. C.

9:45-10:15 "Posture"
U. S. Children's Bureau, Department of Labor, Washington, D. C.

10:15-10:30 "Tommy's Tooth Troubles"
New York Tuberculosis and Health Association, New York City.

10:30-11:00 "Training of Hospital Corpsmen, Including Dental Technicians in the Navy Dental School"
U. S. Navy Medical School, Washington, D. C.

11:00-11:30 "Mouth Hygiene for School Children"
Alfred C. Fones, Bridgeport, Conn.

11:30-11:45 "He Who Laughs Last"
New York Tuberculosis and Health Association, New York City.

11:45-12:00 "Clara Cleans Her Teeth"
Thomas B. McCrum, Kansas City, Mo.

P. M.

2:00- 2:30 "The Reward of Courage"
American Society for the Control of Cancer, New York City.

2:30- 2:45 "Your Mouth"
Edwin N. Kent, Boston, Mass.

2:45- 3:15 "Working for Dear Life"
Metropolitan Life Insurance Company, New York City.

3:15- 3:30 "The Epithelial Inlay"
U. S. Army Medical Museum, Washington, D. C.

3:30- 3:45 "The Dental Hygienist"
Alfred C. Fones, Bridgeport, Conn.

3:45- 4:00 "Principles of First Aid"
U. S. Bureau of Mines, Washington, D. C.

4:00- 4:15 "Tommy Tucker's Tooth"
Thomas B. McCrum, Kansas City, Mo.

4:15- 5:00 "Science of Life" V, VI, VII, XII.
U. S. Public Health Service, Washington, D. C.

Wednesday, October 26

A. M.

9:00- 9:45 "Science of Life" I, II, III, IV.

9:45-10:15 "Come Clean"
U. S. Army, Washington, D. C.

10:15-10:30 "Tommy's Tooth Troubles"
New York Tuberculosis and Health Association, New York City.

10:30-10:45 "Clara Cleans Her Teeth"
Thomas B. McCrum, Kansas City, Mo.
10:45-11:15 "Health Twins at Work"
American Social Hygiene Association, New York City.
11:15-12:00 "Pasteur" I, II, III. This film, a history of the life and work of Louis Pasteur, is a gift to the U. S. Department of Agriculture from the French Government. U. S. Department of Agriculture, Washington, D. C.

P. M.

2:00- 2:45 "Pasteur" IV, V, VI.
U. S. Department of Agriculture, Washington, D. C.
2:45- 3:00 "Tommy Tucker's Tooth"
Thomas B. McCrum, Kansas City, Mo.
3:00- 3:15 "He Who Laughs Last"
New York Tuberculosis and Health Association, New York City.
3:15- 3:30 "Your Mouth"
Edwin N. Kent, Boston, Mass.
3:30- 4:00 "Working for Dear Life"
Metropolitan Life Insurance Company, New York City.
4:00- 4:15 "Through Life's Windows"
4:15- 4:45 "Mouth Hygiene for School Children"
Alfred C. Fones, Bridgeport, Conn.
4:45- 5:00 "Posture"
U. S. Children's Bureau, Department of Labor, Washington, D. C

Thursday, October 27

A. M.

9:00- 9:45 "The Science of Life" V, VI, VII, XII.
U. S. Public Health Service, Washington, D. C.
9:45-10:00 Demonstration by Hygienists of the Rochester Dental Dispensary.
Harvey J. Burkhart, Rochester, N. Y.
10:00-10:15 "Clara Cleans Her Teeth"
Thomas B. McCrum, Kansas City, Mo.
10:15-10:45 "The Reward of Courage"
American Society for the Control of Cancer, New York City.
10:45-11:00 "Tommy's Tooth Troubles"
New York Tuberculosis and Health Association, New York City.
11:00-11:15 "He Who Laughs Last"
New York Tuberculosis and Health Association, New York City.
11:15-11:30 "Tommy Tucker's Tooth"
Thomas B. McCrum, Kansas City, Mo.
11:30-12:00 "Mouth Hygiene for School Children"
Alfred C. Fones, Bridgeport, Conn.

Announcements

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Academy of Periodontology, October 20-22, 1927, Detroit, Michigan.

American Dental Assistants Association, October 25, 26, 27, 1927, Detroit, Michigan.

American Dental Hygienists Association, October 24-28, 1927, Detroit, Michigan.

American Dental Association, October 24-28, 1927, Detroit, Michigan.

American Dental Trapshooters League, October 24-28, 1927, Detroit, Michigan.

American Society of Oral Surgeons and Exodontists, October 21-22, 1927, Detroit, Michigan.

American Society of Orthodontists, April 30-May 1-3, 1928, Buffalo, N. Y.

National Association of Dental Examiners, October 22, Book-Cadillac Hotel, Detroit, Michigan.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesday in each month from October to June inclusive.

September (1927)

Maryland, at Hagerstown (12-13).

October (1927)

Florida, at St. Petersburg.

December (1927)

Ohio, at Cleveland (6-8).

February (1928)

Minnesota, at Minneapolis (Feb. 29-March 2).

March (1928)

Louisiana, at Shreveport.
Montana, at Missoula (29-31).

April (1928)

California, at Stockton (9-12).
Maryland, at Baltimore (April 30-May 2).
North Carolina, at Greensboro (16-18).

Chicago Dental Society, at Chicago, January 24, 25, 26, 1928.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Indiana, at Indianapolis, November 14, 1927. Secretary-Treasurer, J. M. Hale, Mt. Vernon, Indiana.

New Jersey, at Trenton, December 5-10, 1927. Secretary, John C. Forsyth, 148 W. State St., Trenton, New Jersey.

THE DENTAL SOCIETY OF THE STATE OF NEW YORK

The Dental Society of the State of New York will hold its 60th annual meeting at Syracuse, N. Y., on May 16, 17 and 18, 1928.

A cordial invitation is extended to all ethical dentists who are members of State Societies to attend. The Society also bids all ethical Canadian dentists a very cordial welcome.

For information with reference to the literary exercises, clinics, etc., apply to

A. P. BURKHART, *Sec'y.*,
57 E. Genesee Street,
Auburn, N. Y.

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

CHICAGO DENTAL SOCIETY ANNUAL MEETING AND CLINIC

January 24, 25, 26, 1928

Drake Hotel, Chicago

The 1928 meeting of the Chicago Dental Society will again be held at the Drake Hotel, Chicago. This year's feature will be a three-day meeting as compared with the two-and-a-half-day meeting heretofore.

An excellent program is assured by the chairman of the program committee, Arthur D. Black.

Exhibitors should apply for space to Howard C. Miller, 30 N. Michigan Ave., Chicago.

HUGO G. FISHER, *Secretary.*

INDIANA BOARD OF DENTAL EXAMINERS

The Indiana Board of Dental Examiners will meet at 8 a. m., Nov. 14, 1927, at the State House, Indianapolis, in the House of Representatives Room, for the purpose of examining all applicants with proper credentials. Applications should be in the hands of the secretary one week before the board meeting. For applications, clinical requirements, and other information, address

J. M. HALE, *Sec'y-Treas.*,
Mt. Vernon, Ind.

NEW JERSEY BOARD OF REGISTRATION

The State Board of Registration and Examination in Dentistry of New Jersey will hold its regular examinations at Trenton, N. J., commencing Dec. 5, 1927, and continuing for five days thereafter.

The license fee is $25.00; reexamination fee, $10.00.

Practical tests required: Insertion of an approximal gold filling, with the approximating tooth in position, compound approximal amalgam filling and a silicate filling, the candidate to furnish his own patient; taking of impression, bite, selection of teeth, articulation and trial plate, the candidate to furnish his own patient; practical examination in mouth diagnosis.

Attention is invited to the following quotation from the dental law of New Jersey: "Applicant shall present to said Board a certificate from the Commissioner of Education of this State, showing that before entering the dental college he or she had obtained an academic education consisting of a four-year course of study in an approved high school or the equivalent thereof."

In accordance with this law, the secretary will issue application blanks only on presentation of the required certificate from the Commissioner of Education, State House, Trenton, N. J.

Application must be filed, complete, ten days before the date of examinations (Nov. 25, 1927).

Address all communications for further particulars to

JOHN C. FORSYTH, *Secretary*,
148 W. State St.,
Trenton, N. J.

PSI OMEGA FRATERNITY

The annual meeting of the national chapter of the Psi Omega fraternity will be held at the Detroit-Leland Hotel, the Psi Omega headquarters, on Monday afternoon, October 24. The Psi Omega banquet will be held on Monday evening. The sessions of the Grand Chapter will be held Friday and Saturday, October 21 and 22.

R. E. DENNEY, *Secretary.*

XI PSI PHI

Xi Psi Phi headquarters will be in Rooms 227 and 229, Hotel Tuller, during the American Dental Association meeting. All members are requested to register. The meeting of the Alumni Chapter will be held on Monday, October 24, the annual banquet, Monday night, October 24, at Hotel Tuller.

H. B. PINNEY, *Sec'y-Treas.*,
108 N. State St.,
Chicago, Ill.

DENTAL CORPS EXAMINATION

A competitive examination for appointment to the Dental Corps of the United States Navy will be held Sept. 19, 1927, at the U. S. Naval Medical School, Washington, D. C. Appointees must be citizens of the

United States, between 21 and 32 years of age at the time of appointment, which may be one or two months later than the date of completion of the examination. Applications to take the examination should be made in accordance with a form which may be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C., and must be accompanied by certificates of birth and citizenship, of graduation from an accepted high school or the equivalent and from a recognized dental school, and two or more letters testifying to good habits and moral character. The examination will be both theoretical and clinical and the usual duration is from seven to ten days. No allowance can be made for the expense of persons appearing for examination.

E. R. STITT,
Surgeon General, U. S. Navy.

AMERICAN SOCIETY OF ORTHODONTISTS

The next annual meeting of the American Society of Orthodontists will be held, April 30-May 3, 1928, at the Hotel Statler, Buffalo, New York. Members in good standing in the American Dental Association are cordially invited to attend.

WALTER H. ELLIS, *President.*
CHARLES R. BAKER, *Sec'y-Treas.*,
708 Church St.,
Evanston, Ill.

ASSOCIATION OF MILITARY DENTAL SURGEONS OF THE UNITED STATES

The annual meeting of the Association of Military Dental Surgeons of the United States will be held this year at Detroit, Mich., in connection with the annual meeting of the American Dental Association. Headquarters of the association in Detroit will be at the Statler Hotel, and a parlor on the ballroom floor of this hotel will be set aside for the convenience of our members and friends.

The annual banquet of the association will be held on the evening of Thursday, October 27, 1927, at the Prince Edward Hotel, Windsor, Ontario, Canada, and, if practicable, the annual business meeting will be held immediately after the banquet. All dental officers of the Army, Navy, U. S. Public Health Service and National Guard, and ex-officers thereof and all officers of the Dental Corps Reserve of the Army and Navy are cordially invited to attend the banquet. Tickets may be obtained from the Association Headquarters at the Statler Hotel or from Lieut. Col. Bion R. East, Dent.-Res., 48 Martin Place, Detroit, chairman of the local committee.

AVERY G. HOLMES
(Captain, Dental Corps, U. S. Army)
Secretary-Treasurer.

RESOLUTION ADOPTED BY THE AMERICAN SOCIETY OF ORTHODONTISTS

It has come to the attention of the American Society of Orthodontists that quite recently a bill designated as Assembly Bill 1214 has been introduced into the Legislature of the State of California, which provides for the creation of a new profession to be known as the profession of orthodontia. The bill further provides that this profession shall be under the jurisdiction of the state board of medical examiners and subject to their examinations.

Orthodontia is now established and practiced as a specialty of dentistry and is so recognized by all of the leading universities of this country and by the dental examining boards of all of the states of the Union.

The American Society of Orthodontists has been importuned to record an expression regarding the revolutionary change which would be brought about by the enactment of such a law as that proposed by Assembly Bill 1214 referred to. Be it therefore

Resolved: That the American Society of Orthodontists, in regular assembly, this fourth day of May, 1927, does hereby record its unanimous and unqualified disapproval of such vicious and indefensible legislation, such legislation in the opinion of its members being detrimental to the best interests and welfare of the public at large. Be it further

Resolved: That a copy of these resolutions, together with a copy of the aforementioned bill be sent to the dental press, to the Secretary of the American Dental Association and to the secretaries of each of the dental societies of all of the states of the Union.

SOCIAL EVENTS FOR WOMEN

American Dental Association Meeting, Detroit, Michigan, October 24-28, 1927.

REGISTRATION FOR WOMEN

Arrangements are being made to register all women at the General Motors Building and also at the Book-Cadillac Hotel. They will receive Visitors' buttons entitling them to participate in the entertainment features provided by the American Dental Association.

The Entertainment Committee has set aside the Italian Garden foyer and Parlor "A" at the Book-Cadillac Hotel for visiting ladies and their friends.

Mrs. Camilla E. Pearce, Hostess, and her assistants will be in constant attendance at the ladies' headquarters. Anything that will add to the pleasure and comfort of our lady guests will be looked after by Mrs. Pearce. She will arrange:

Shopping tours	Theater parties
Sight-seeing tours	Bridge parties
Fashion show	

TUESDAY, October 25, 12:10 to 2:00 p. m.
RECEPTION AND LUNCHEON

Crystal Ballroom—Book-Cadillac

tendered by

The First District Dental Society of Detroit to the officers of the American Dental Association, distinguished guests and ladies in attendance. Guests are requested to obtain invitations for ladies at the time of registering or notify the Entertainment Committee previous to the meeting.

Miss Sarah Burnham will be the hostess.

THURSDAY, October 27, 8:00 p. m.
PAGEANT AND GRAND BALL

In the Grand Ballroom of the Book-Cadillac Hotel there will be a special entertainment, an historical pageant: It has been said that the progress of any profession is in direct proportion to its interest in its own history. Therefore, a rare opportunity is to be given the members of our profession to study in a most interesting way the history of dentistry from its beginning as a scientific profession to the present day. The American Dental Association is the greatest single factor in the history of dentistry, therefore, with this as the keynote, a pageant has been developed which will be entertaining, enlightening and enjoyable. No effort has been spared by the dentists of Detroit and others to make this pageant one long to be remembered. You will have the privilege of meeting in spirit more than forty of these noble pioneers who prepared the way for this great coming Detroit Session.

Immediately following the pageant will occur the opening of the Grand Ball. For this occasion the Crystal Ballroom, Venetian Room and the Grand Ballroom will be used. Two special orchestras have been engaged to furnish the music. For those who do not dance, rooms have been set aside for cards.

A special supper will be served from 11:30 p. m. to 1:00 a. m.

Miss Sarah Burnham will be hostess and have complete charge of the social features for the evening.

Entertainment Committee:

J. M. Finlayson	Harold Schmidt
Paul S. Crosby	Don S. Graham
Charles Marcinkiewicz	Ray Roussin
Carl Bowman	William A. Cook
R. E. Patterson	P. J. O'Reilly
H. E. Putt	Lyman L. Jones
M. E. Ruen	Clinton R. Martin
Chester Forman	Frederick W. Dean
Ray Recind	Albert H. Dredge

O. W. WHITE, *Chairman*,
507 Fine Arts Bldg.,
Detroit, Mich.

Even with the spacious ballroms of the Book-Cadillac Hotel the Committee expect the space to be taxed to capacity, and have decided to limit the number of tickets issued. We urge those who wish to attend to secure tickets by mail or immediately upon arrival. Tickets may be secured at the General Motors Building, or ladies' headquarters at the Book-Cadillac Hotel.

THE SCIENTIFIC FOUNDATION AND RESEARCH COMMISSION MEETING

There will be a meeting of the Scientific Foundation and Research Commission of the American Dental Association, Sunday, Oct. 23, 1927, at 2:30 p. m., in the Book-Cadillac Hotel, Detroit, Michigan.

It is expected that every member of the Research Commission will be in attendance.

FRANK O. HETRICK, *Chairman*,
R. H. VOLLAND, *Secretary*.

RESOLUTIONS ON DEATH OF DR. HOFF

It is fitting at this time to pause in the midst of a busy session to do honor to our friend, Nelville S. Hoff, who has recently gone to the Great Beyond. Dr. Hoff was one of our early, faithful and devoted members.

In his passing, we have lost an esteemed confrère, one who was both teacher and friend, and a man whose council was sought by many. Be it therefore

Resolved: that this society record his passing, with sincere regret, and spread on its minutes this token of our love and esteem.

AMERICAN SOCIETY OF ORTHODONTISTS,
HERBERT A. PULLEN,
MILTON T. WATSON,
Committee.

Chicago, May 4, 1927.

PATENTS OF INTEREST TO DENTISTS

1507738. Forceps, Albert B. Johnson, New Britain, Conn.

1508062. Producing dental plates, Mendel Pianko, Chicago, Ill.

1508070. Dental syringe, Joseph G. Rosen, Chicago, Ill.

1508958. Amalgam mixer, George E. Cox, Wilmington, Del.

1509041. Dental appliance, Harry T. Hyams, DeKalb, Texas.

1508430. Burr, Claud H. Wells, Gouverneur, N. Y.

1509542. Dental chair, Frank E. Case, Canton, Ohio.

1509720. Toothbrush, James A. Donnell, Austin, Texas.

1509431. Collapsible tube, Martin H. Ittner, Jersey City, N. J.

1509161. Filing hollow bodies, especially the cavities of human teeth, with metallic filling substances, Jacob Maurer, Konstanz, Germany.

1509376. Dental impression tray, Frank C. Rodgers, St. Louis, Mo.

1509377. D ntal impression tray, Frank C. Rodgers, St. Louis, Mo.

1510304. Illuminated tongue depressor, Will J. Cameron, Chicago, Ill.

1510416. Forceps, F. Pietz and J. Coletti, Saginaw, Mich.

1511096. Dental clasp, Hugo Aderer, East Orange, N. J.

1510818. Paste-tube collapser, Herbert E. Barron, Dupo, Ill.

1510538. Valve for dental plates, A. H. R. Berthold, Chicago, Ill.

1511161. Making sets of artificial teeth, Joseph M. Buchanan, Freeport, N. Y.

1510785. Composition of matter for the treatment of pyorrhea, Key Kamiya, and T. H. Wakino, Los Angeles, Calif.

1511712. Appliance for regulating teeth, Dexter S. Bacon, Minneapolis, Minn.

1511443. Dental wax and compound annealer, H. A. Bonoff, Los Angeles, Calif.

1511671. Chin support, B. B. Jones and E. O. Fields, Milan, Tenn.

1511422. Dental apparatus, Oscar H. Pieper, Rochester, N. Y.

1511638. Denture attachment, Isidore Stern, New York City.

1511639. Denture attachment, Isidore Stern, New York City.

1512126. Process and machine for grinding completed plates of artificial dentures, James S. Miller, Trenton, N. J.

Copies of these patents may be obtained for 25 cents each, by addressing John A. Saul, Solicitor of Patents, 509 Seventh St., N. W., Washington, D. C.